THE ROMANCE OF THE SHIP

By
E. KEBLE
CHATTERTON

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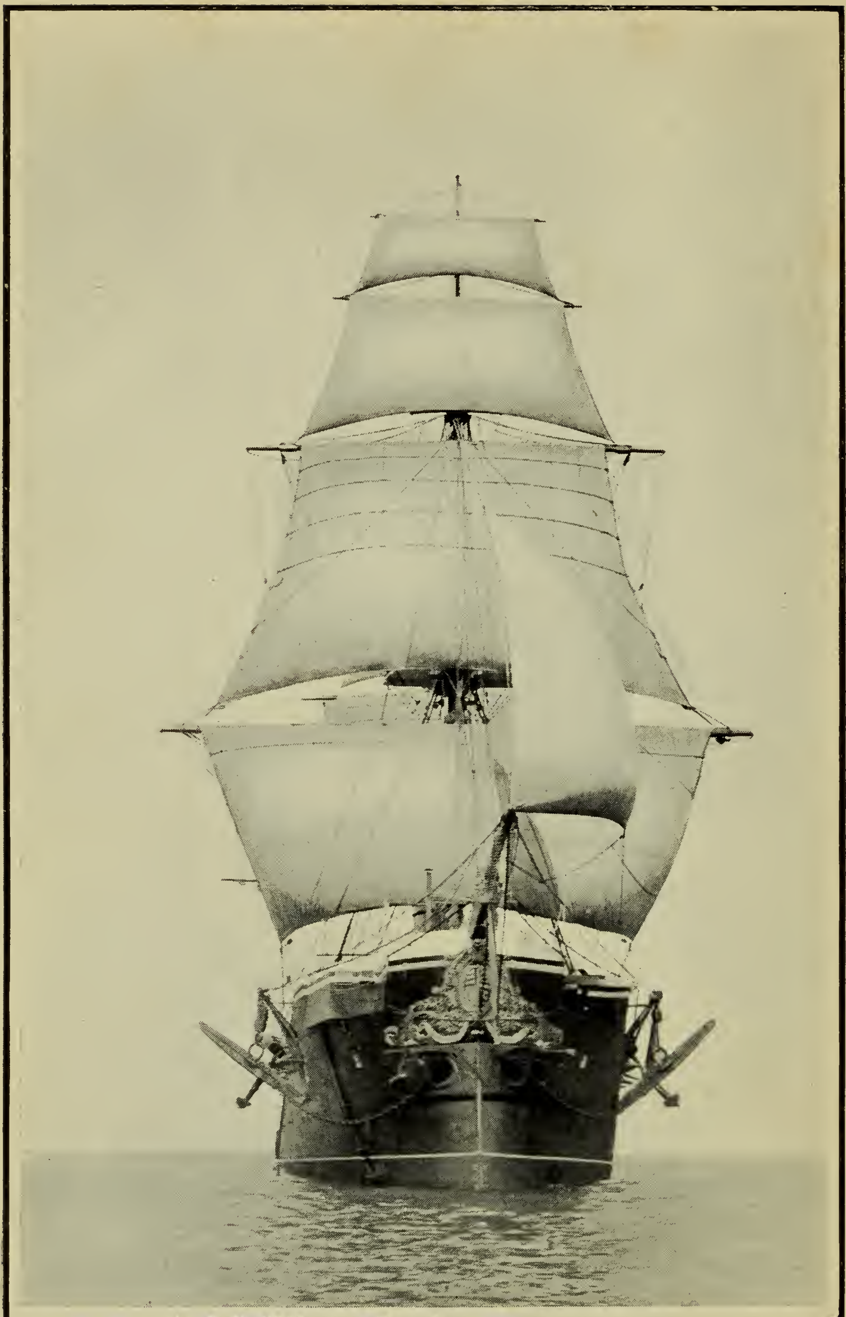

From a photo by *Stephen Cribb, Southsea*

FROM SAIL TO STEAM

This striking photograph shows H.M.S. *Minotaur*, an armour-clad warship of 9,870 tons, and represents the period when sails were still used in the Navy as auxiliary to the steam-engines. It will be seen that she carries on her fore-mast the following sails: fore-sail, top-sail, t'gallant, and royal.

THE ROMANCE OF THE SHIP

THE STORY OF HER ORIGIN AND EVOLUTION

BY

E. KEBLE CHATTERTON

AUTHOR OF

"SAILING SHIPS & THEIR STORY," "DOWN CHANNEL IN THE 'VIVETTE,'"
"STEAM SHIPS & THEIR STORY," &c. &c.

WITH THIRTY-THREE ILLUSTRATIONS

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TO

ALL WHO SEE IN THE SHIP ONE OF THE MOST ROMANTIC OF THE WORKS OF MAN, AND LOVE HER ACCORDINGLY, THESE PAGES

ARE DEDICATED

PREFACE

TO attempt to describe within the limits of one book the whole evolution of the ship from the days of her crude beginnings and limited utility to the present time, when she has become so essential a feature of modern life, may seem to be an ambitious scheme. The term ship denotes so much, and includes so many different types, that it would be utterly impossible to deal with the subject fully in any single book of moderate dimensions, and for all but a few readers such a volume would be not only too large, but too technical. What I have had in my mind has been to inspire those who are interested in the following chapters with a keen desire to seek for fuller information elsewhere, and with this object in view I have endeavoured to present not so much a catalogue of the varying characteristics of vessels in all ages, as a vivid picture of the gradual growth of this most romantic of the works of man, and a general idea of its development in so many and wonderful ways.

What is here set forth is the fruit of a good many years of historical research and of personal, practical experience due to a natural love of the sea, and enthusiasm for what seems to me one of the most fascinating studies in the whole range of knowledge. Of the shortcomings of this book no one is more conscious than the writer himself; but if the vast range of the subject, and the difficulty of sustaining the reader's interest whilst keeping the great mass of details within bounds, as well as the task of making a highly technical subject intelligible to those unfamiliar with sea terms, be considered, he trusts that some slight indulgence may be granted him.

E. KEBLE CHATTERTON.

1910.

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CHAPTER I

THE FIRST SHIPS OF THE NILE

WE know not who it was that, in the dim dawn of the world's history, first dared to trust himself to the frail support of some object floating upon the treacherous and unstable waves. Every record of himself and his craft has disappeared: but for his enterprising audacity in seeking to tame the terrors of the deep this primitive man deserves a place of honour at the head of that long line of great seamen which includes, through the flight of time, men of such varying personalities, voyaging in such different ships, as Pytheas and Columbus, Drake and Raleigh, Captain Cook and Nelson, Franklin and a myriad others who obeyed that instinct of the sea which, even in our own times of peace and plenty, is happily handed down from father to son, from generation to generation.

Like very many other benefactors of the world, this first sailor has come and gone without leaving behind him any memorial other than the good which he accomplished. His praise is in the ship and in every species of craft which is used for the service and progress of man. Little could he realise all that was bound to follow when he brought into being the first boat or ship. Not solely was he essaying a new and striking experiment; not merely was he turning his activities into a new channel for his own personal edification, but, in bringing into being the ship, he was doing more to promote civilisation, commerce, and the general prosperity of nations than could have been achieved in almost any other way. For it is when you pause for a moment that you realise all that the ship means. Except it had been by her assistance continents had remained undiscovered, countries had continued to be kept apart by the vast seas intervening. New ideas could not have been brought into the lands, islands would have remained isolated, and, except between land-girt territories, all exchange of wealth, of thought, and of development must necessarily have been restricted to the immediate locality. Without the ship, for instance, neither Christianity nor civilisation would have reached the inhabitants of our own isle. The whole continent of America would have remained unknown and unpeopled. Looked at in its most elementary function, the ship is just a floating bridge—a ferry, if you like—which connects land and land. But its early growth, its romantic development, and ultimate perfection are full of so much interest and, incidentally, provide so many arresting surprises, that we are readily pardoned if we think of her not so much as a convenient and essential means of transit as a being which has almost a human personality, which has pluck and endurance to wrestle against the winds and waves which for ever seem to be waging an eternal warfare against her. It is for this reason that we speak of the ship more frequently as "she" rather than "it." We feel that of all inanimate things the ship is the most human. Because of her nobility of birth, her length of pedigree, her dignity in appearance, and her heroic behaviour when called to carry valuable human lives and freight across the ocean, we feel that it is permissible to allow some strong bonds of sentiment to bind us to her; and so we honour her by separating her from the dull things of man's creation that have neither voice nor expression, and raise her to our own class of animate beings. Like ourselves, she has a distinct character and personality of her own. And because of her admirable beauty and grace, coupled with her capriciousness and sprightliness, we class her among the category of the sex feminine.

We begin, then, to endeavour to see how the boat became a ship, how the sailing ship grew from something almost insignificant to a vessel of such a size and such dimensions that to-day, with her cloud of white canvas hovering over her cliff-like hull, she seems almost to have reached the final stage of development where beauty is combined with strength. We shall not end our inquiry there, however, even though much of the sentiment attached to the ship disappears when we leave the sails on shore and fit boilers and engines in the hull and the paddle or propeller outside. But we shall proceed onward and watch how the advance of science has modified the hull, rigging, and general utility of the ship, and this not merely for the peaceful pursuits of trade, but in obedience to the demands which have been made upon the ship that at all times and for all nations she should be ready for offence and defence in the event of war. It is a long story, but one which to every man and boy should appeal in no uncertain way. For with the ship is associated so much that will ever be regarded as worthy of admiration. The finest exhibitions of grit and heroism, of patient endurance during peril and deprivation, the grandest examples of courageous enterprise, belong as much to the sea and ships as to the battle-field. But there are, besides, virtues of an especial kind that are bred on the sea, which in the lives of the world's great seamen, and in even the coasters and fishermen of our own land to-day, are at once manifest, and unmistakably differentiate the man from the wastrel. Let us, then, proceed without further delay to see of what kind were the ships which in all ages have been so much associated as well with the development of countries as of men's own characters.

Since history is silent regarding the first sailing man, perhaps we may be permitted to make a mental picture of his earliest exploits. Between man and water has always existed a feud: the one is ever trying to overcome the other. A fair day may see the fleet sailing confidently out towards the horizon, only to be mercilessly sent to its destruction when the winds have conspired to help the treacherousness of the sea. And so man gradually builds ships of greater and greater seaworthiness, in order that the waves and storms shall annoy, rather than destroy, her; but even to-day liners disappear without leaving behind even the barest bits of wreckage. No doubt that first sailor of whom we are speaking was thoroughly conscious of this feud. He knew that the river or tidal estuary was his sworn enemy, and this the more excited his primitive fighting instinct. He was determined to try. Perhaps, having noticed the carcasses of dead animals floating down with the stream or tide, he may have taken the skins of the wild animals captured in the chase, inflated them, and entrusted his body to their support. Perhaps, also, by this means the art of swimming (so natural to animals) was acquired by man. But under no circumstances could these bladder-like supports be called boats. He was entirely at the mercy of the wind and current, and the danger of drowning was at hand all the time. To take the place of the skins he makes a raft, but even that is clumsy and difficult to govern. Finally, convinced that wood has in itself the power of carrying not only its own weight but the burden of man, he finds in the forest one mighty tree, hews it down, and away, seated on its trunk, he goes along the river. With one of the branches for his primitive paddle, he is able to get along with greater ease and comfort than on the skins, and because of the rounded under-water surface of the tree-trunk the resistance as it goes through the water is not considerable. The next stage consists in hollowing out the trunk till she becomes in fact and name a "dug-out." The space thus obtained gives him room for his bow and arrows and spears, as well as for carrying the spoils of his hunting. For a time, then, he paddles, until finding what the modern canoeist quickly discovers, that a few hours of this kind of work is exceedingly fatiguing, he begins to utilise his strength and weight to better purpose. So in the absence of the modern rowlocks, or even wooden pegs, he attaches a paddle to each side of the boat and binds them to the hull with leather thongs. Thus he is able to sit in his boat or stand, to send her up or down stream as he pleases with a minimum amount of physical effort.

That is a great improvement, but in the course of time, as he advances towards complete development, he seeks to harness the wind which sometimes impedes, sometimes accelerates, his movement through the water. The skin of one of the animals that he has killed might be employed in a new way, and so, hoisting it up, supported only by one paddle whilst steering with the other, he finds as he goes against the stream that the favourable wind, bellying out his skin-sail, increases his rate of progress beyond anything he had previously contemplated. He is able to sit at the bottom of his boat without doing any work, whilst the little ship carries him on quietly to his home further up the river, where the banks are closer together and the water shoals more gently, where he can beach his craft easily for the night.

As time goes on a spar is used exclusively for the mast, and instead of the chance skin one specially prepared for the purposes of a sail, and cut to suitable shape, will be adopted. Some day, too, this man's

Dug-Outs

An interesting picture showing the development of the primitive idea of crossing water astride oɪ a log. The log has now been hollowed out, thereby becoming more manageable and gaining greater carrying capacity.

descendants will learn the art of tacking, of going against the wind. The tree-trunk will be improved in many ways, including size and shape of the primitive hull, but these changes are for those who shall come after. Already he has done much—he has brought into being that great and wonderful thing the sailing craft. That is enough for one lifetime.

Surely it must have been on some such lines as these that the earliest navigator proceeded to free himself from the limitations in which he first found himself. From this stage we shall, however, rarely be compelled to argue upon mere theory, but from actual facts before us we shall be able, with perhaps a few breaks where the chain of evidence is not complete, to show, step by step, the continuity of man's struggle to evolve first from wood, then from iron, and finally from steel, the ideal ship that shall prevent the sea from claiming its everlasting toll.

We turn our eyes, therefore, to the East, whence civilisation has spread. We look across the Syro-Arabian desert to Babylonia, and what do we see? Not much, unfortunately, at present. It was no doubt the Tigris and the Euphrates which first, of all waters, witnessed the strange and novel sight of man sailing sometimes—sometimes, also, paddling his craft up and down the river. Perhaps we may yet receive at the hands of explorers such data as will assist us to reconstruct afresh the earliest historical ship, but unhappily the discoveries so far made have revealed matter belonging only to a very much later period. Our story, therefore, cannot begin as early as the earliest civilisation, but at any rate we can start confidently from about the year 6000 B.C., when Babylonian settlers, having come westwards, had already settled down in the country we know as Egypt. Happily, from about this date actual illustrations of Egyptian ships are still in existence. In the British Museum, for instance, there is preserved an amphora or vase bearing a crudely drawn but unmistakable ship. The mast and square-sail are there set very far forward in the bows. There is a cabin in the stern of the ship for her commander, whilst in the bows also is a small platform on which the look-out man can stand. In almost all the illustrations of Egyptian ships we find this man in the bows depicted, and sometimes with a pole in his hand so that he may sound the water when the ship is getting into the shallows. Whether this, the earliest representation of a ship known, was a dug-out or not is not quite certain. If it were a dug-out, then the high bows and stern must have been added to the hollowed-out tree-trunk.

But besides the evidence which is obtainable from old Egyptian vases, there are two other sources of information which enable us to see the growth of the ship in Egyptian times. First, there are the wall-paintings which have been found by excavators in tombs and forgotten palaces of the previous rulers of this ancient people. Secondly, there have within recent years been brought to light little models of boats and ships which, in confirming and supplementing the information of the wall-pictures, are most valuable. For a time Egyptology had remained an unknown science, but the finding of the Rosetta stone in the eighteenth century, which enabled the hieroglyphic writings to be deciphered, gave the impetus necessary to study existing monuments in the nineteenth century, and now, thanks to the careful labours and excavations of European and American scholars, all sorts of wonderful articles have been brought to the surface—jewels and models and many other things —throwing a clear light on to the arts, religion, habits, literature, and minds of the ancient Egyptians. But especially valuable has been the excavation of the Temple of Queen Hatshopsitu at Deir-el-Bahari, the thorough exploration of which is only now barely completed. From Gizeh, Sakhara, and elsewhere the information concerning the early Egyptian craft is such that we can form a fairly clear conception in our minds of these early navigators. It would not be difficult to devote the whole space at our disposal to a study of just this Egyptian section alone, but since we have set out to present an account of the ship as she developed in all ages, we shall not be able to give more than the most essential characteristics which marked the Egyptian ships.

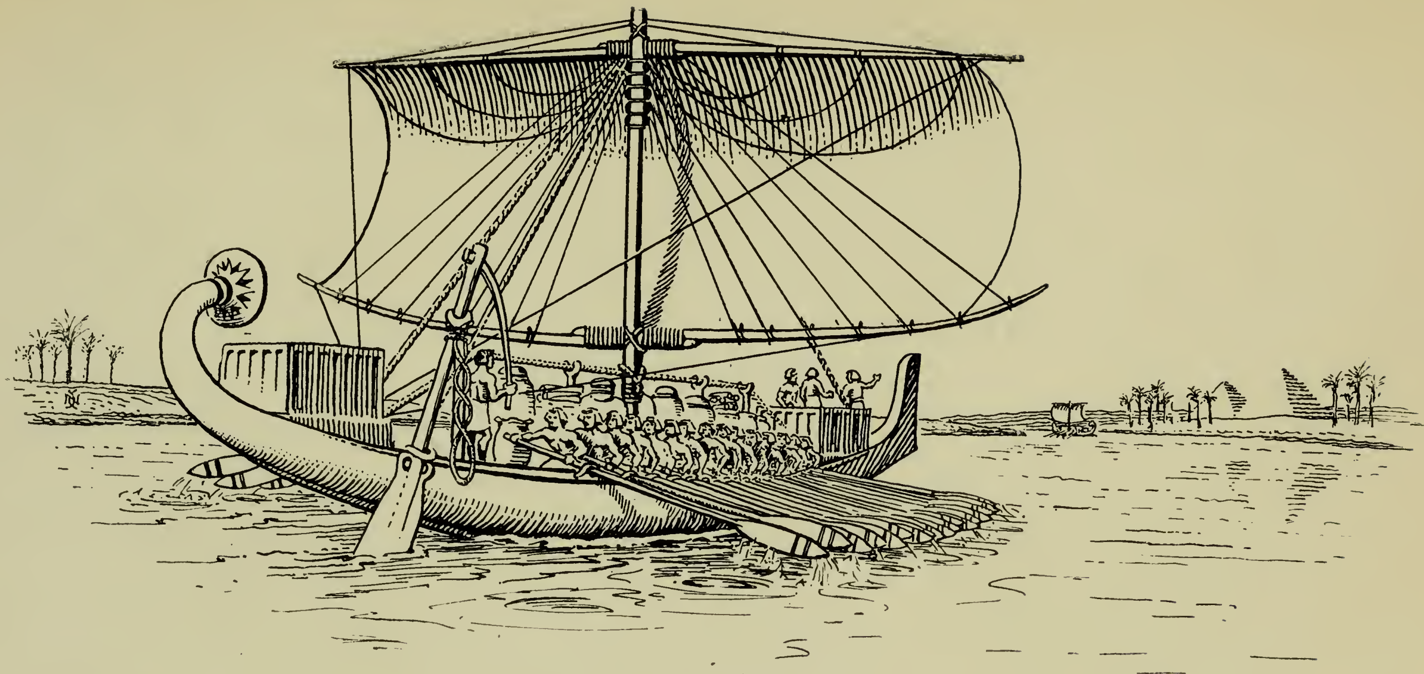
The history of Egypt in the early times has been divided into various dynasties, but before these we must not forget that there existed a pre-dynastic period, to which the ship on the British Museum vase just mentioned belongs. It is when we come to assign definite dates that we are confronted with no little difficulty, for Egyptologists themselves are not in entire agreement, some ascribing a much later and others a far later date. But if we assign the pre-dynastic period to that time which existed before 6000 B.C. we shall not get very far wrong. Professor Flinders Petrie dates the First Dynasty from 4777 B.C., but another eminent scholar is of the opinion that 3180 B.C. is nearer the truth. However, we can rest content that somewhere about four or five, or even six thousand years before the beginning of Christianity Egypt was in a highly civilised condition, and not in a rude barbaric state. Thanks to the work of exploration, and copies made on the spot, we have most instructive illustrations of the ships of the Fourth and Fifth Dynasties. We see the Egyptians busily engaged in making their ships; we see the smaller craft being strengthened by the stalks of the lotus plant, bundles of which are being carried down to the yard on the backs of the shipwright's men. The smaller craft would seem to be performing the work which a modern dinghy is employed in, carrying only three men. So far the real ship, as distinct from the boat, has made only a slight advance towards perfection. In design she is scarcely superior to the pre-dynastic craft. Her mast is not made of a single pole, such as we in our own time are accustomed to use; it is, on the contrary, double, wide at the base and coming to a point at the top. In other words, it is exactly the shape of the letter A, the foot of each of the two sides of the triangle fitting into the ship inboard. Such an arrangement was most sensible and necessitated no supporting rigging on either side, such as we see in the modern sailing vessel. At the same time, in order to support the mast from aft, a number of shrouds, usually totalling ten, lead from just above the middle of the mast to the stern. It is a curious repetition of history that after so many hundreds of years, in which the single stick has been used (I am not referring, of course, to topmasts), the British navy has returned to the fashion in vogue during the Fourth and Fifth Dynasties of the Egyptians. If the reader should chance to see H.M.S. *Dreadnought*, he will notice that both her masts are built on this principle; and even the *Lord Nelson*, an earlier ship, has one of her masts thus made. There is just this difference between these modern masts and the Egyptian: whereas the latter were literally A-shaped, even to having the cross-piece, the modern British warships have not two legs, but three, so that in battle the risk of having the entire mast shot away is minimised.

But to return to the Nile, we find that these sailing craft were supplied with a large square-sail fitted with yard but no boom. The braces by which the yard and sail could be trimmed to the wind led, like the shrouds, to the stern of the ship also. In order to support the mast at the forward end, a fore-stay led down to the bows, and an additional backstay is sometimes shown extending from the top of the mast to the extremity of the stern. The sail at this stage is lofty but narrow, and comes right down to the deck. At this period, too, the steering was effected by a number of men placed in the stern, varying from two to six according to the size of the vessel. Each of the six men was supplied with a steering paddle and took his orders from the pilot. On big ships we see the sailor who worked the braces sitting on the cabin top, while below him, sheltered from the sun, the commander with his thong-stick, by which to stir up his lazy crew, sits in authority. But it must not be thought that these craft always proceeded under sail-power. The prevailing wind in Egypt is north, and the current of the Nile of course flows from south to north. Therefore, when ascending the river the ship could spread its large high sail and go against the stream, but on returning the mast was taken out of its sockets, laid aft on the cabin top with the legs pointing forward, and the oarsmen would get out their long paddles and row back with the assistance of the stream. Egyptian illustrations show that enormous crews were carried on these ships in proportion to their size. As many as forty-five are shown in one instance, including the six steersmen, the man on the cabin top, the commander, twenty-nine oarsmen, and eight other men, whose work, besides keeping a look-out, probably included the lowering and raising of the mast and attending to the sail. It is probable that the number of men shown rowing really represent but half of this section of the crew, and that had the Egyptian artist depicted the ship bow or stern on, we should have seen another twenty-nine oarsmen at work on the other side.

The hulls were even at this period most certainly hollow, and of great sheer, so that both bow and stern had enormous overhang high above the water, being a much exaggerated example of the design of the bow and stern which the reader may have seen on most modern racing yachts. Sometimes there is a figure-head shown at the bow.

We have illustrations, too, showing a shipwright's yard of the time of the Sixth Dynasty. The men are engaged in their various operations, and the head naval constructor or superintendent is seen carried down in a kind of Egyptian sedan-chair to learn how the work is progressing. Some of the men are hammering and chipping away at the wood; others are engaged in fashioning and fixing into place the various portions of the vessels, and in order to get the ends of the ship into the right shape we see the extremity of the overhang attached by a strong thong to a ring in the ground; but there is nothing to show whether steaming-boxes were first employed before the strain was put on the wood. Reference has been made to the employment of the strong lotus stalks for binding and strengthening the hulls, but there was also employed, at any rate for the bigger ships, a powerful truss—no doubt made from twisted thongs—which led from one end of the ship to the other, being stretched on forked posts so as to spread the strain. Such a truss was as thick as a man's waist, and capable of enduring a strain of three hundred tons. The necessity of this truss is quickly seen to be obvious, for with such a craft as the Egyptians had, having considerable overhangs at bow and stern not water-borne, both the latter must necessarily tend to drop downwards for the reason that they lack sufficient support. At the same time, the waist of the ship which is supported by the water must tend, when the strain comes, to curve upwards. The object, then, of this mighty truss was to prevent the overhanging bow and stern from dropping and the centre of the ship from being pushed upwards. In the illustration of the shipwright's yard just alluded to we see the men energetically setting up the truss and putting the forked posts in proper position.

During the Twelfth Dynasty Egypt had reached a remarkably high state of civilisation and prosperity; consequently it is in this period that her ships exhibit very considerable improvements. Notably for our present study this time is important, because it first shows the abolition of the old-fashioned method of steering by several paddles and the introduction of the helm. This is seen to consist really of a long pole with a wide blade where it meets the water. The other end rests on a forked prop, rising to a great height above the helmsman, who works his helm by means of a strong rope attached thereto. We know that this is true, because we have excellent illustrations found in the Temple of Deir-el-Bahari, in which the details of the ships are shown with consummate care. But quite recently still further evidence of the ships of this period has been obtained, owing to the interesting little models which were discovered at Rifeh and are now in the Manchester Museum. The reason for these model-ships being placed in the tombs is found in the belief of the Egyptians that they could be transformed by the use of words of magical power into ghostly forms of their originals which had existed on earth, and thus would be able to provide the dead with a means of sailing about on the waters of the Underworld. It is during the time of the Twelfth Dynasty that we see a modification of the sail introduced. Hitherto it



An Egyptian Ship of the Twelfth Dynasty, about 2500 b.c.

Notice the method of steering. The helmsman holds in his hand a stout rope or lanyard, which is attached to the top of the steering-oar, the weight of the latter being supported by a forked prop.

has been lofty and narrow; now it becomes shallow and wide. Up till now the sail has possessed only a yard; but in this present dynasty is added also a boom. We have another illustration of a shipwright's yard—this time of the Twelfth Dynasty—which shows rows of Egyptian ships being completed, with their helms (with carved Egyptian heads at the top, much as we have a carved dog's head on many of our wooden tillers still) already in position, their spars on board though not yet in place, and other details of fascinating interest. Finally, we see the work so far advanced that the masts have been stepped and the yards and booms put in their correct position.

It must not be thought that the navigation of the Egyptians was restricted to the waters of the Nile. They certainly navigated the Red Sea, and some authorities believe that they did so more frequently than is usually supposed. Various expeditions were organised, and fleets of able ships were sent to the land of Punt. To say decisively where Punt was is impossible, for the name was at various times given to different territories. But we can affirm that it was to the east or south of Egypt, and that the object of these highly important Punt voyages was principally in order to obtain incense for the burial of Egyptians. Modern scholars believe that a canal joined the Nile and Red Sea, and that thus the ships made their exit from the river to the more treacherous waters. What these ships were like that went to Punt, happily we know, for they are depicted in wall-paintings of Queen Hatshopsitu's temple. The crude, elementary design of the Nile boats has given way to a larger, more seaworthy, abler type of ship. The exaggerated sheer has become modified, although considerable overhang at bow and stern is manifest. The yard and boom are made in two pieces, being lashed together at the centre, and the truss is shown with great clearness. We see the ships arriving and departing, loading and laden with incense trees, monkeys, woods, ivory, gold, silver, leopard skins; and finally we are shown the safe arrival back in Egypt.

The importance of these ocean voyages to men who had previously been content to sail the waters of a river cannot be over-estimated. They had the twofold result which always follows when inland waterways are forsaken for the sea: they developed, at the advent of greater knowledge and experience, both the seamanship of the men and the design of the ships.

Had we been able to go aboard the later ships of the Egyptians after they had made progress in the art of shipbuilding and learned what to include and what to avoid in their design and rigging, we should have noticed that their method of stowing sail consisted of lowering the yard, whilst the boom (lashed firmly to the mast by thongs) was supported by as many as seventeen topping-lifts, which came down from high up the mast and radiated out along the extent of the boom, as shown in the accompanying illustration. The halyards, which were two in number, led right to the stern of the ship and acted as further support to the mast. Hence on letting go the halyards, the yard would come down on to the boom, the sail would be given a bungling furl, and the whole weight of boom, yard, and sail would be taken by the numerous topping-lifts. But somewhere about the time of Rameses III., 1200 B.C., a still further change was to come over the rigging of the Egyptian ship. For just as the A-shaped mast had long since been supplanted by the single spar, so now the boom which had been introduced was destined to be discarded also. The yard, of course, still remained, to which the sail was bent. But brails were brought into use, consisting of (usually four) ropes which, being attached to the yard, hung down, so that when it was wished to furl sail the yard was not lowered but the brails were cast round the sail, over the top of the yard, and down again, thus, in a clumsy sort of way, stowing the sail to the spar. The explanation of this apparently unseamanlike method is that the weight of the enormous sail and heavy yard was so considerable that, having once got the yard up, the exertion of repeating the effort was not welcome. It involved the work of all hands and took a long time. The same practice, in fact, still obtains on board the African dhows to-day, although the lateen has supplanted the square-sail, and the brails have disappeared.

Such, briefly, is the development of the ship in the very earliest times of which we have any history. We have seen man's primitive canoe grow into a large-sized boat capable of carrying large numbers of men up and down the Nile. Then, thanks to the wholesome influence of the Punt expeditions, we have seen the boat merge into a sea-going ship, with plenty of freeboard and well-planned rigging. I am firmly of opinion that it was as a result of so much sea experience that the boom was abolished. In spite of the enormous advantage which a boom affords in causing the sail to set well and getting the ship as near as possible to the wind, any sailor will tell you that whilst the boom is admirable for smooth waters, yet to have that mighty spar swinging backwards and forwards across the ship on the ocean, whether becalmed or in bad weather, is almost intolerable, besides the very possible chance of the boom suddenly snapping and ripping up the sail, if not doing serious damage also to the hull. It is an axiom that for deep-sea work there is nothing like the square, boomless sail. This, I feel confident, was one of the lessons learned by the Egyptians during their voyages to Punt. At any rate, it is significant that it was after the Egyptians took to deep-sea work that the sail with brails and without boom was adopted. And it may be pointed out at once that this rig was handed on to the Phœnicians, from them to the Greeks and Romans, and even, though slightly modified, is to-day almost identical with the square-sail of the full-rigged ship.

For inland sailing on the Nile there would, of course, be no need to discard the boom ; in fact, there would be many reasons for maintaining it. Later on the invention of tacking was introduced, when it occurred to the Egyptians that the sail might be utilised as well for going against the wind as for running before it. The old square-sail of the Egyptians was nevertheless hardly suitable in shape for a comparatively narrow waterway allowing not too much room for the ship to come round on the other tack. A sail had to be found which would hold a better wind, so the rig for Nile craft was modified at first probably by tilting the yard at such an angle with the mast that the foot of the sail came down very low while the peak pointed well above the top of the mast. The existence of the Nugger above the second cataract with just such a rig to-day, and its persistence in refusing to be replaced, would seem to confirm this. It was thus that the dhow rig followed, dating at any rate from as far back as the fourth century before Christ, during the time of Alexander the Great, whose name is still perpetuated in Egypt by the town Alexandria. The boom was again discarded when the dhows began to cruise along the east African coast and the Mediterranean, and the shape of the sail became triangular instead of quadrilateral. Thus to-day, whether in Spanish felucca or Arabian dhow, or in the familiar sailing craft which glides on its stately way over the Lake of Geneva, this lateen sail survives as the direct descendant of that old rig which was in use when the Egyptians used to cruise to Punt.

CHAPTER II

THE EARLY SHIPS OF THE MEDITERRANEAN

AFTER Egypt suffered that decline which is common to all nations, her place as the pioneer of matters connected with shipping was taken up by the Phœnicians. All the time the Egyptians had been declining the Phœnicians had been progressing. Originally migrating from the Persian Gulf, they had advanced northwards and settled around the Levant, and had even pushed further still, so as to found Thebes in Bœotia, and to inculcate the first principles of civilisation in Greece. So exceedingly prosperous did they become as seamen, traders, explorers, fishermen, and manufacturers that their influence dominated the Mediterranean. We who belong to a race of seamen cannot but extend the keenest admiration to the great daring and enterprise of this mighty nation of the world's first great sailors. The fullest extent of their voyagings cannot, unfortunately, be ascertained with any certainty, yet there is the greatest reason for believing that not only did these Phœnicians sail round Africa (starting from the Red Sea and arriving back in Egypt after three years), but that they crossed the Bay of Biscay to Britain, the North Sea to Norway, and even the Atlantic to South America.

What, then, was the nature of the ships in which the Phœnicians sailed the seas?

Very decidedly they were indebted to Egyptian influence in the design and rig of their craft. But since the Phœnicians were sea-sailors rather than river-sailors, they wisely chose not so much the model of the Nile vessels as those which time and experience had shown to be fitted for ocean voyaging. Thus they had no use for the great heavy boom which had been found so serviceable on the inland waters of the Egyptian river, for the Phœnicians' minds thought of oceans rather than rivers, however large the latter might be and however far they reached into the country. Consequently, they adopted the vessel pretty much as she had been in the time of Rameses III., mentioned in the previous chapter. The sail was suspended from the yard without a boom along the foot; the brails (or bunt-lines) for reefing hung down from the yard to the deck, and the double steering-oar on either side of the stern remained also. In order to guard the ship against danger brought by a following sea, the stern was carried high above and overhanging the water. As the Phœnician vessels became bigger, of course, the sails grew in proportionate area, and we see the number of brails increasing to as many as six. When at anchor, the yard would remain aloft and be brailed up in the manner already indicated in our last chapter. There are, in fact, still in existence Phœnician coins wherein this is depicted in no uncertain manner. Along the bulwarks ran a line of shields to protect the crew, whilst the bow terminated in a ram. In this last respect we see an important departure from the type of ship as evolved by the Egyptians. Whereas the latter were a peace-loving race, the Phœnicians were conquerors by ambition and purpose, and for this reason it was not rarely that they were brought into conflict with the vessels of other people. It is, in fact, to the Phœnicians that the distinction belongs of having invented both the bireme and the trireme.

The stern, which we saw in the Egyptian ships as the place of honour for the commander, was still reserved in the Phœnician vessels, and in the case of the admiral's ship this portion of the craft was further distinguished by the erection of a staff with a crescent at its top as well as by an overhanging rich carpet. Flat-bottomed, long, and narrow, these vessels sometimes reached a length of three hundred feet, and their speed, either when running before a wind or when propelled by oars, must have been anything but slow.

As the Egyptian influence had been handed on to the Phœnicians and modified, so the Phœnicians handed on to Greece and Rome the ship as they had left her. We have abundant information as to Greek and Roman vessels, not merely from the writings of classical authors, but from most interesting discoveries that have been made in Greece, Italy, and Northern Africa. In the year 1834, for instance, in the Piræus were unearthed some highly important records of the Athenian dockyard superintendents, containing inventories of the Athenian arsenals of the fourth century B.C. These have since been elucidated and supplemented by further research.

As early as the thirteenth century B.C., Greek vessels were sailing over the sea, and five hundred years

A TRIREME

These vessels were used by the Greeks and Romans both in peace and war. The trireme was fitted with three banks of oars, and mention is made of quadriremes, and even quinqueremes, fitted with four and five banks of oars respectively. Note the rostrum or beak in the bow used for ramming an enemy's vessel.

later the inhabitants of the Grecian peninsula and the western coasts of Asia Minor were keenly interested in maritime matters. The Greeks busied themselves in overseas trading, to their great material welfare, and in the waters of the Black Sea found prosperous fishing-grounds.

When we come to examine a Greek war galley as depicted on existing vases of a date somewhere about 500 B.C., we see at once that the Egyptian design is still marked, even though it has undergone changes at the hands of two other nations. The one large square-sail and mast, without boom, but with brails as before, and the double steering-oars at the side of the stern, are still there. Similarly, the after end of the ship is gradually raised till it overhangs the water. The sail is hoisted by two halyards which come down on either side of the mast, and when it needed to be reefed so many turns were taken with the brails by sending men aloft on to the yard, who would pass these lines round the sail and then throw them down on deck. The yard, as had been the case in the Egyptian ships that went to Punt, was made of two separate spars lashed firmly together. In this, and indeed many other respects, the Mediterranean galley of to-day bears so close a resemblance to the ancient Greek and Roman fighting ships that the descent from an historic ancestry is unmistakable. The Latin word for the yard—*antennæ*—was always used in the plural, and indicated this doubly-constructed spar. The bows at the waterline frequently terminated in the shape of a boar's head on a Greek vessel, which projected forth like a ram. Eyes were also painted on the bows of the ships, as the ancients believed that thus she might be able to see her way over the sea. In the bows was constructed a forecastle, which afforded protection for the ship against a head sea. From there a flying-deck ran aft to the stern, so that the marines could do their fighting without interfering with the sailors below who pulled at their oars. Their method of fighting on sea was as different in principle from our modern naval tactics as the galley is from a modern battleship. Practically the whole manœuvre consisted in getting alongside the enemy and fighting in a hand-to-hand manner, bows and arrows and spears forming the weapons. But considerable importance was attached to the power of ramming the enemy's ship, so that to guard against this a special structure called an *aphlaston* was placed at the stern of a vessel to protect her against the vicious onslaught of the ram. At the same time, in order that the ram itself should not penetrate too far into the other vessel's stern and so break off, there was usually added, higher than the ram itself, a figurehead which allowed the ram to penetrate only to a limited extent. Although we find illustrations of the galleys with sail set, yet we must not forget that these sails were merely used as auxiliaries, and that the main propulsion was by means of oars. The Greek and Roman galleys never went into battle with sails up; before the engagement the mast and sail were taken down. It is for this reason that the Mediterranean craft were slow in making development. What was preferred was a vessel that could manœuvre quickly and handily, that could attack the enemy and get out of the way of his thrusts with the greatest speed. Since such was the demand put upon naval designers and builders, there was but little encouragement to build a real ship capable of keeping the sea and riding out bad weather.

Usually the galley was hauled ashore every night, but when kept afloat she was anchored near the shore, with bows pointing towards the sea and the stern made fast to the beach, a gangway being carried on board for convenience in disembarking from the stern. When getting off from the shore the gangway was slung over the stern, and the vessel was pushed off into deep water by means of poles carried in readiness. Two kinds of sails and masts were carried by these warships, but before battle the larger mast and sail were put ashore, since so much gear would have unnecessarily hampered the working and fighting of the ship. Within recent years considerable attention has been given to the manner in which the oars of an ancient warship were disposed. To accept the opinion of some that as many as thirty banks of oars were customary is now scarcely possible, for the height to which a vessel would thus be raised above the water would have made her far too top-heavy and unsafe, either in battle or in peace, without considerably deepening her draught. But even if the latter were increased the vessel would still be less easily manœuvred than at first, and would need extra power from the rowers. The probability is that there were at most three banks of oars, and that when the crew was very numerous several men worked at each oar.

It is a well-known fact that, speaking of a craft, generally length means speed. (Experiments in connection with the boats used in the Oxford and Cambridge boat-race have also proved this.) Consequently, in the case of the ancient war vessels of the Mediterranean length was insisted upon, and to such an extent that the galleys were known as "long ships," while the merchant craft were, because of their more beamy and rotund appearance, designated "round ships." In the British Museum there is a Greek vase bearing a singularly beautiful illustration of a merchant ship of about the year 500 B.C., which shows the mast placed amidships, the sail close-reefed, a stern still resembling that of the Egyptian vessels, but a bow that is so modern in its appearance that it is almost identical with what was customary on the famous sailing clippers of the second half of the last century, or indeed to be seen on almost any steam-yacht of to-day. The vessel is seen to be decked-in, while the steersman sits as usual in the stern, where he can easily trim the sail as well as govern the steering. Whilst the galley, as we have just remarked, was really a rowing ship with sails only as auxiliaries, the merchantman or round-ship was primarily a sailing vessel, and carried oars only for emergency in calms, in entering harbours, and for accelerating her speed to escape the attacks of pirates.

With regard to the building of Greek and Roman ships (for we may continue our study of them together, since their resemblance is so close), the merchantmen were usually of pine, while the warships were also

GREEK VESSELS

These were used by Alexander the Great to explore the Persian Gulf. The Phœnicians were the most daring navigators of classical times. Note the form of rudder, and the ladder hanging at the stern for embarking and disembarking.

made of fir, cypress, or cedar. When we recollect that the shores of the Mediterranean, at any rate around Greece, were rich in timber, red-lead, iron, and copper, it is not surprising that the shipbuilding industry in these early days was so extensive. The keels of the galleys, in order to withstand the rough usage of being hauled ashore at night, were of oak, this being selected with great care. The masts and other spars and oars were made out of fir or pine. When setting to work to build these ships, the regard which to-day is paid to the due seasoning of the wood was ignored in the early centuries, for the reason that otherwise the wood became too hard to be pliable. Nowadays a shipbuilder is able to bend his wood to the required shape by placing it first in steaming-boxes. The seams were caulked with tow, and when the hull was made quite water-tight she was coated below the water-line with tar or wax usually, the wax being first melted and then laid on with a brush. Afterward the top-sides were painted a colour, green being the usual hue for pirate-ships, so as to render them almost invisible in the distance against the background of the sea. Round the stern beautiful designs, representing classical groups of figures, were painted also.

The fastening of the wood was effected by means of bronze and iron as well as wooden pegs, and the galleys, like the old Egyptian ships, had a strong cable to prevent any possibility of the hull "hogging." The ropes were manufactured by twisting ox-hides or the fibres of the papyrus plant, whilst the sail was of white canvas or cloth, being often coloured for a special purpose—a black sail, for instance, denoting mourning; a purple sail signifying the ship of an admiral or a sovereign. Pirates also sometimes coloured their sails green.

Originally anchors were merely a heavy weight of stone, but later they took proper shape and were made from iron and lead, the cables being of chain and of rope. The use of flags and lights for marine purposes was prominent even at this early date. From the voyages of St. Paul as recorded in the Acts of the Apostles, we find that the use of the lead-line was known, and from this account, coupled with an illustration still existent on a relief of about the year A.D. 200, we find that (though in a slightly modified form) the Egyptian steering method of a rudder on each of the ship's quarters was continued thus late. St. Paul's ship, when she was in difficulties and had to slip her cables so as to run for the shore, "loosed her rudder bands." These bands extended from the gunwale to the rudder, being fastened about half-way down the latter, so that when necessary the rudder could be hauled up clear of the water, just as the reader may have noticed in the case of a Thames sailing barge, or, to put the matter more simply still, as in the operation of hauling up a centre-board in a sailing dinghy. From the same account we find that there were also two-masted vessels in use at this time, for right forward St. Paul's ship had an artemon-mast and artemon-sail, or, as we should say nowadays, a foremast and foresail. The discovery of some mosaics six years ago near to Tunis in Northern Africa, belonging to a period not later than A.D. 200, revealed just such a two-masted vessel depicted with considerable detail, the foremast and main, with supporting shrouds, being clearly seen. Among the same mosaics, which represent only ships of the mercantile marine, and not war vessels, is the *navis actuaria*, which shows a light vessel capable of being rowed, yet furnished with one square-sail, mast, yard, stays, and rope-ladder, up which one of the crew is ascending to attend to the canvas. This ship is of particular interest, since this was the very kind which Cæsar mentions as having been employed during an expedition to Brittany. The design of the hull shows a curious admixture of Egyptian and Greek influence, the old overhanging stern, but a ram-like bow being manifest.

Rome had been so busy extending her conquests as to neglect the development of the merchant ship in the exclusive encouragement of the war craft. But at any rate, by the second century of our era Roman merchant vessels had begun to develop into something more than mere glorified rowing-boats, and the manner of their rigging showed at once an intelligent perception of the duties of a sailing-ship and a knowledge which can only be obtained by experience of ships, the sea, and their mutual relationship. Thus we find bollards, or strong blocks of timber, being placed both forward and aft for mooring the ship when alongside a quay. Dead-eyes for shrouds are introduced; there is a purchase for "sweating" down the forestay tight; a triangular topsail is introduced and set above the yard of the square-sail, and is in two pieces; there are sheets and braces; whilst the brails for reefing pass through rings on the foreside of the canvas, so that the method of brailing the sail up was not dissimilar to the way in which domestic venetian blinds are drawn up.

With the age of luxury on shore, of course, came its expression also afloat. In the course of time not merely were sails ornamented—a practice that was not dead even in the time of Queen Elizabeth in the sixteenth century—but vessels were built with every conceivable regard for luxury and physical comfort, until they became rather floating palaces than sea-going ships. Magnificent saloons, bronze baths, rooms made luxurious with exquisite marbles and paintings, statues and rich mosaics; elegant deck-houses, libraries, vine-rows, trees, jewels, parti-coloured sails, dancing and concerts—these were the accessories of the great galleys of Caligula as he sailed along the coast of Campania. To this day there remain at the bottom of the Lake Nemi two such craft as these, belonging to about the date A.D. 37; but in consequence of the many centuries which have passed since these craft were sunk, it is highly improbable that they will ever be brought to the surface again, notwithstanding that various attempts have been made in different ages.

With regard to the navigation of the early voyagers of the Mediterranean, they had for their guidance no such thing as the compass, but in clear weather could coast from one landmark to the other. Beyond that there was a good deal left to chance, and to that natural instinct which was no doubt far more developed in their minds than in most moderns. There were a certain number of lighthouses, and on some parts of the coast high towers were erected, so that the flames thereon burning might during the night act as due warning to the navigators, while the smoke during the daytime would both do this and indicate the state and direction of the wind at that point. This is the primitive origin of our modern system of beacons and coast-lighting.

In entering or leaving harbour one of the crew would give warning of the ship's approach by blowing a trumpet, so lessening the risk of collision. This incident is actually depicted on an old Roman lamp now in the British Museum, which also shows an early lighthouse.

What precisely was the connection between the ships of the Mediterranean and of Northern Europe originally we cannot, unfortunately, say. That there was some connecting link seems undeniable, for reasons which we shall refer to in the following chapter. But just as we owe to Greece and Rome in matters of civilisation generally more than we can ever repay or ever realise, so it was in shipbuilding. Though their development of ships continued rather on the restricted lines of the warship, to the exclusion for a long time of the more peaceful trader, yet the advance made by these ancients in the knowledge and practice of shipbuilding was so great as to lay the foundations along the Mediterranean coast—in Venice, Genoa, and the Spanish Peninsula—for those great enterprises which, after a few centuries, were to send forth the intrepid explorers and navigators of the Middle Ages, while as yet Northern Europe had scarcely awoke to the full realisation of what the sea meant, to what new lands it led, to what vast sources of wealth and power. Because all civilisation has spread from east to west, it was but natural that the territories along the Mediterranean, insomuch as they were nearest to the fount of civilisation, should in shipbuilding and maritime development be the first to excel. Even if to-day we have far surpassed all their efforts, it is only right to admit that, but for their first lessons in building big craft, our own development of building big-bodied ships would have been long delayed.

CHAPTER III

THE EVOLUTION OF THE SHIP IN NORTHERN EUROPE

WE come now to that part of Europe where the climate, differing so much from that of the Mediterranean, must from the very first have called for a type of craft of greater seaworthiness than was found adequate for the Greeks and Latins. The waters of the North Sea, English Channel, and the Bay of Biscay are sufficiently stormy and boisterous to demand ships of stronger, bolder design and build. The amount of freeboard, for instance, that sufficed for a light Roman galley would have been utterly unsafe in northern seas, and we shall see in this present chapter how immensely struck Cæsar was with the difference between the craft to which he had been accustomed and the vigorous ships in which the Veneti, a Gallic tribe, were wont to put to sea. But before we get so far in our story, let us begin at the earliest relic we have of the ship in the northern part of the continent.

Along the Scandinavian coast, from as far north as Trondhjem even to the isle of Gothland, are to be seen to this day a number of wonderful carvings made in the rocks. The precise age of these is a matter of doubt, for they have been conjectured to belong at the earliest to about the year 1500 B.C. and at the latest to about 50 B.C. For myself, I believe that the earlier date is the more correct. At any rate these rock-sculptures show, depicted with much quaintness and lack of proportion, both ships and men of an early period of Scandinavia's history. Now, the significant point of these illustrations is that the ships of that country, even at such a remote date, are clearly seen to be of much the same shape as those the Vikings sailed in later, and many of the Norwegians and Swedes sail in to this day Roughly speaking, these primitive craft, which correspond to the ships of the Phœnicians, are long, narrow, and double-ended (*i.e.* with a bow at each end), with what is probably meant to be a ram shown in the bows. Sometimes a mast is shown amidships, and altogether the resemblance to the Phœnicians' ships is so close that it seems very probable that the earliest inhabitants of this northern peninsula obtained their first ideas of ship-design from these wandering Phœnicians. On the other hand, it is possible that these Northerners obtained their ideas otherwise, if it be true that their first colonisers came across Europe from the shores of the Black Sea, and that the ships which in the course of time they began to build were based on the Phœnician models, which they had been accustomed to see used in fishing or trading in the eastern waters of that part of Europe. In either case the Phœnician influence is there, derived either directly or indirectly.

Whether these rock-sculptures depict properly built vessels or only "dug-outs" (or craft hollowed out of tree-trunks) we cannot, of course, determine from this evidence. But the first vessels of Northern Europe were formed—as we have plenty of proof to convince the most sceptical—of tree-trunks hollowed out, and very probably the ships depicted in the Scandinavian rock-carvings belong to that class. In many parts of Norway and Sweden the dug-out craft is still in use, the trunk of the oak, because of its thickness and durability, being especially selected in preference to other woods.

As long as man was in the Stone Age his ship belonged to the dug-out class. Like the Australian aborigines, the inhabitants of this period had all their tools and implements made out of stone, and both the felling and hollowing out of the giants of the forest was done solely by instruments of this material. A little later and the dug-out is found strengthened by the addition of ribs, and the fairly flat bottom has a wooden keel attached thereto. In various parts of England, Scotland, and Germany there have been unearthed, and are still preserved in local museums, a number of these prehistoric dug-out craft. Possibly the reader may have seen such a craft himself, but in case this is not so, perhaps we may take the famous dug-out which was discovered at Brigg in Lincolnshire in May of 1886 and was recently presented to the Hull Museum. Here is a vessel $48\frac{1}{2}$ feet long, 6 feet wide, and $2\frac{3}{4}$ feet deep, having been hollowed out of an oak tree of such a size that it must have been at least 18 feet in circumference, and of such a height that the branches did not begin until 50 feet from the ground. Such a boat would be propelled by sail as well as paddles, and would carry as many as forty men, so that quite a considerable pace could be obtained in calms, or even adverse winds, when the sail was not in use. When these dug-outs happened to run on a rock or snag and holed their sides the repairs were effected by means of wooden patches and pegs. Thongs were also employed for sewing up the patch, and finally moss was used for caulking the hole tight against the water. The Brigg boat clearly shows that she had sprung a leak at some time, for on her starboard side a rift of 12 feet has been made and repaired in the manner mentioned. Expert authority has determined the date of this vessel as somewhere between 1100 and 700 B.C.

But the next stage of advancement is more than interesting, for the Stone Age man, instead of adding the ribs last to his ship, now makes them first; and instead of laboriously hewing down and scooping out the tree, he sews together the hides from the carcasses of the animals he has killed in the chase and stretches these over the ribs so tightly as to make a skin-boat. The coracle, as used in certain parts of Ireland and Wales, is practically the same type of boat as that used in the later Stone Age. That these skin-boats were in actual use in early Britain is perfectly clear, for Cæsar himself mentions that when he required some boats to get his troops across the river Sicoris during his first Spanish campaign, he ordered his men to make boats of the kind that they had learned previously from the Britons, these consisting of a wooden keel and a frame of ribs and osiers, covered with hides. Finally, in the Bronze and Iron Ages man has learned to fashion for himself such wonderful tools that he can fell the tree with ease; but, most important of all, he can cut it up into planks, and by means of metal nails he can fasten them together, the one layer overlapping the other and the gaps caulked either with moss or the hair of animals. Thus he is able to build a craft more endurable than the hide-boat and made with greater ease than the clumsily hollowed dug-out.

This represents a highly important advance, for it is here that true shipbuilding begins. To what a degree some of the northern peoples had progressed in this art may be gathered from Cæsar's account of the naval campaign fought against the Veneti in the year 54 B.C. The vessels of the latter, we are told, were flatter than the Roman ships, so as to take the ground easily. They had very high bows and sterns, to make them more seaworthy, being built of oak and enormously strong. Nor was this at all superfluous, for the Veneti dwelt on the Bay of Biscay in the north-west corner of France, where the full force of the Atlantic makes itself heavily felt. We learn from the same record that these ships had cross-beams a foot thick, fastened with spikes as thick as a man's thumb, and that their anchors had iron chains, and that the sails were made of skin and dressed leather. It was found that although the Roman ships—the *naves actuariæ*—were far more easily manœuvred, yet they could not make much impression on the hulls of the Veneti when ramming, for the reason that the latter were so immensely strong. Cæsar's record, in fact, makes it singularly clear that his enemy's ships were of a thoroughly practical, seaworthy type, capable of enduring storms and hard usage.

Now, the design of these Biscayan craft, as mentioned by Cæsar, is practically that which has been familiarised to us by the Viking ships. The high prows and sterns not unnaturally took Cæsar by surprise after being accustomed to the Mediterranean shipping. From Tacitus we learn that Germanicus, in the year A.D. 15, built a number of vessels of somewhat similar design near the mouth of the Rhine. The same author refers to the Suiones (the earliest name for the Scandinavians) as having a powerful fleet whose ships were also double-ended, so that they could easily be beached, and in battle be rapidly manœuvred either way with rapidity. This double-ended design has remained a very popular method of shaping craft in the more northerly climes of this continent. Not merely in Norway but in Scotland to-day many of the fishing craft are of this type, while both lifeboats and whalers' boats are designed on much the same principle.

One of the most surprising facts, when we come to examine the history of shipbuilding, is the remarkable proficiency which was possessed by the Vikings of Norway. One of their modes of burial was to place the body of the great sea-king in his ship, which was hauled ashore, and after his various possessions—his horse, dogs, and weapons—had been placed by his side, a sepulchral chamber was built over the ship and an enormous mound of earth was erected over the vessel and its contents. Since the second half of the nineteenth century a number of these Viking ships have been excavated, and the excellent state of preservation in which they have been found is due, no doubt, to the fact that the air has been excluded for so

A Viking Ship

The sails of Viking ships were frequently gaily coloured and decorated with quaint devices. Notice the dragon's head at the forward end of the ship, and the shields arranged along the bulwarks.

many centuries. The most recent discovery was in 1903, at Oseberg, on the western side of Christiania Fjord; but fine as this craft was found to be, she was not so glorious a specimen as that unearthed at Gogstad, near to Sandefjord, in the year 1880. From these excavated vessels, together with a vast amount of detail left to us in old Scandinavian literature—in the "Sagas" which narrate the deeds of the sea-kings, their mighty exploits and wanderings in their long-ships—it is now possible to form a very full picture of what a Viking ship looked like when she came foaming across the turbulent North Sea. It may perhaps be of some convenience to the reader if we here reconstruct what would have met our eyes had we, twelve hundred years ago, cruised about the ocean that separates us from the land of mountains and fjords.

As she came on, we should first have been struck by the gaily coloured sail of the Viking ship. Square in shape, much wider at the foot than along the yard, and exceeding the breadth of the ship herself, it would have been found to be made of flax, strengthened around the edge with hide. Sometimes the sail was striped, or embroidered, or made of velvet by the more delicate hands of the Viking's women-folk ashore. Stripes of red and blue, purple and gold, with quaint patterns depicting some historical incident, were added, as a relief to the white canvas, the various portions of the sail being sewed together with thread. For shortening sail, we know from an existing coin that the Norse did carry a row of reef-points attached to the sail. At the bow of the boat, rising well above the hull, was a dragon's or serpent's head or other device. Warships, for instance, carried the dragon's head at the stem, vessels belonging to the Snekkja (or serpent) class having a serpent's head in a like place and the animal's tail at the stern. A single row of oarsmen was on either side of the ship, and these were protected by shields from the enemy's darts. The handles of the oars we should have seen to be decorated, whilst the tiller-head was also carved with great taste.

There were five separate compartments, the commander's room being at the stern. Then came the room for the second in command, and the place where the arms were stored. Further ahead of that was the central section of the ship, where the rowers did their work and the mast was stepped, this latter being capable of being lowered and raised by means of a tackle, stays supporting it when it was needed for setting the sail. There was a gangway running down the centre of the ship, the rowing benches being placed on either side. Forward beyond this midship portion, the bow section of the ship was divided into two where the pick of the crew were placed, to whom fell the duty of preventing the enemy succeeding in boarding the ship. Here also was the standard-bearer. Most beautifully built and designed, with a knowledge of naval architecture that, even according to modern standards, is admirable, these vessels were both fast and weatherly, a replica of the Gogstad ship having crossed the Atlantic some years ago for the Chicago Exhibition. One or two small boats were carried on board, according to the ship's size, and she also carried rollers for beaching and launching.

These vessels were built very flat amidships, with fine ends. The steering method was as follows, and will be immediately seen to resemble that of the Roman ships mentioned in the previous chapter. Instead of having a steering-oar on either quarter, as in the Mediterranean craft, the Viking ships had one alone, and that on the *stjornbordi* or steering-board—starboard—side. But it was now fixed to a projecting block of wood, where it could have sufficient play for its purpose. Into the neck of the rudder, which began by being the handle of the steering-oar, the tiller fitted at right angles. In a subsequent chapter we shall see the rudder taken from the side of the ship and placed at the stern, and with the exception of this modification there remains, in rig, design, and construction, a remarkable similarity between those old Viking ships of a bygone age and many of the sailing craft of Norway and Russia to-day.

When the vessel was under sail, the holes for the oars were closed with wooden shutters to keep out the water. At night a tent was stretched across the vessel, being kept open by wooden stretchers, of which a pair, beautifully preserved, with carved heads, are still in existence, having been found on board one of the Viking ships. The crew off duty would get into their leather sleeping-bags and turn in for a sleep beneath the tent. But the Vikings did their passages usually by coasting from point to headland, and when brought up did their cooking ashore, making use of bronze utensils. From the yard of the sail depended braces leading down to the after part of the ship, but there was not always carried a boom at the foot of the sail, although sometimes this was brought into use—no doubt for the purpose of setting the sail exceptionally well when close-hauled; but we may say that even if the Vikings understood the art of tacking, their vessels would not have sailed very near the wind, probably no closer than seven points. To come round on the other tack would have necessitated the employment of the oars to get such a length of ship about; for the position of the sail so nearly amidships, and with no head-sail, though excellent when running before a fair wind or on a broad reach, was not advantageous for beating to windward.

One sometimes finds wonderment expressed that these open ships could possibly survive the furies of a winter's gale. The answer is quite simple; the Vikings, like their Mediterranean predecessors, did not go into danger recklessly. Their sailing seasons were restricted to spring and summer, and in the autumn the ships were hauled ashore until the fine weather should come round again. Though they had no compass, they were able to make voyages of considerable length, not merely to the southern coast of England, but to Constantinople, to the Holy Land, to Iceland, and from the latter island to the nearest shores of North America. The whole ship-building world of to-day is under a debt of deep gratitude to this vanished race of sea-kings. The encouragement which they gave to the scientific designing and building of good, wholesome vessels meant a great deal for Northern Europe, for without this aid not merely Britain but other countries would have remained content for some time with a far inferior and less serviceable type of vessel. So reliable and suitable was this Viking kind of ship found by the inhabitants, not merely of Britain but of the coast-line extending from Scandinavia as far south as the northern shores of Spain, that whenever the people along this vast stretch of coast-line depicted a ship it was always, until the middle of the fifteenth century, with perhaps one or two rare exceptions in the fourteenth, of the double-ended type, with one mast and sail amidships, the sail being furled when at anchor to the yard, and not the yard and sail lowered to the deck. In many respects we find the counterpart of usages characteristic of the Mediterranean seamanship. Such were, for instance, the use of trumpets for announcing the approach of a vessel when entering or leaving harbour; the custom of sending some of the crew aloft to shake out the sail when getting under way; and, following the example of the southern seamen, usually in a state of nakedness, so that their clothes might not get caught in the gear aloft. But the clumsy method of reefing as practised in the south was banished in the North Sea when the Vikings introduced the much superior method of shortening sail by means of rows of reef-points. To send a man up on the yard to throw the brails over it may have been none too pleasant an occupation even in the Mediterranean, but experience, in carrying out this feat of seamanship on a squally day in the Channel or the North Sea, must soon have suggested to the minds of these sailor-men that some better plan might be devised.

It must not be imagined that these open Viking ships were of small size. On the contrary, the Gogstad ship, for instance, is only just under 80 feet long, with 16½ feet beam and a depth of 6 feet amidships, and weighing about 20 tons. In comparison to their length they drew very little water, for the ship of which we are now speaking was afloat in anything over 3 feet 7 inches of sea. Clinker built—that is, with the planks overlapping each other, as the reader will have noticed in the construction of most beach boats—of good, strong oak, with planking 1¾ inches thick and caulked with cows' hair, with accommodation for 32 oarsmen, 16 on either side, such a ship was capable of giving a good account of herself when under the command of a mighty Norseman, whose spirit knew not what it was to be daunted, whose determination could never be satisfied except with victory. With a brave, fearless heart within him, a strong, valiant crew to obey his commands, and a fine, bold ship in which to be carried from coast to coast, the Viking could do pretty much as he liked and journey almost anywhere he chose. No one had better ships than his, and few ever had in so marked a manner that sea-instinct which is born in a man and subsequently developed, but cannot be instilled into a man if it is wholly absent. The Vikings journeyed across hundreds of miles of sea from their homes and devastated the shores of England and France, navigating to the inland towns situated on rivers and inlets, committing pillage and piracy everywhere. They were a power not to be reckoned with lightly, but either to be opposed strenuously, or to be obeyed on such terms as the vanquished could obtain from the vanquishers.

For a time the Viking sailors had it all their own way. Their ships were superior to any afloat, and their attacks none could resist, until at length, just before the close of the ninth century, Alfred came to the English throne and determined to put an end to these depredations. But how was he to proceed? Our own ships could not fight with any chance of victory against the enormous long-ships; that was quite evident. Therefore he determined to beat the enemy at his own game, by opposing him with superior rather than inferior vessels.

CHAPTER IV

THE DEVELOPMENT OF THE SHIP IN THE MIDDLE AGES

THE decision of Alfred to build ships of the Viking type, but twice as long, much faster, and of greater freeboard, was another step towards the big ship which was yet to come. Although the help of Frisian pirates had to be called in to carry out the seamen's duties, yet Alfred's scheme won in the end, and the country was at last freed of its harassing foe. But the long association of our countrymen with the Saxons and Angles in their Viking ships had settled in their minds the type of vessel that was to continue in use along our shores. Until after these Vikings had taught us, ours was certainly not a country of sailors. It is not without importance to remember this fact, and that Norway, with the neighbouring sea-countries, was for a long time ahead of us in maritime matters. For the Roman invasion and occupation of Britain had done practically nothing for us in this respect. With them no doubt came the introduction of their Roman craft, but except for estuary work they would not be particularly suitable, and when Rome withdrew her protection the country was left without defence against the great warlike sea-nation living across the North Sea.

But when we had once learned the type of ship that was wanted and had acquired the art of building it, as soon as peace was sufficiently established matters went ahead. England began to have not merely single ships of great size, but powerful fleets. In the time of Edgar (A.D. 959–975) there were no less than 4000 ships to guard our island, being split up into four fleets of a thousand ships each, for duty on the north, south, east, and west coasts. At the same time trade was being carried on between the Continent and this country, and many of our ships were engaged in the herring fishery. Gradually the Viking long-ship was modified until she was more suitable for carrying cargo and passengers, if less conveniently disposed for fighting. At the same time, it is quite clear that not for some time was the Viking shape much modified. The ships, for instance, of William the Conqueror, in which he and his men invaded England, as well as the vessels of Harold, with their striped sails and hulls, their Viking shape of bows and sterns with figureheads, steering-rudder, and so on (all clearly shown in the Bayeux tapestry), indicate that in the eleventh century the influence of the Viking ships was still strongly felt. And this evidence is confirmed by illustrations on old fonts, seals, and manuscripts. Before the close of the twelfth century the tendency was for these vessels to become still larger, for a ship bearing the name *La Blanche Nef*—probably so called because of her white hull—which eventually foundered, was carrying no less than three hundred passengers, being propelled by fifty oars.

But an important development was to follow from the result of the Crusades. Whereas the ships of this country had continued for hundreds of years to perform coasting voyages as far west as Ireland and as far north as Norway and the Orkneys, they were now called upon to make a long ocean passage across the Bay of Biscay to the other end of the Mediterranean. The effect of this extended voyaging was twofold. First, it gave our seamen an opportunity of seeing the contemporary shipping of the south ; and secondly, it developed and improved their seamanship in many ways. Now, the advance of the Mediterranean vessels had continued along the lines we indicated in an earlier chapter. Thus, the galley had gone on increasing in length, but at the same time the merchant ship had also been encouraged to a very large extent, as the trade of the Mediterranean countries gradually but surely increased. Perhaps she had become a somewhat clumsy vessel, but her portliness was demanded by the amount of merchandise she was called upon to carry. There is little doubt that this kind of ship grew to large dimensions, and as early as Richard I.'s crusade there was a big three-masted vessel, powerfully built and capacious enough to carry fifteen hundred men aboard, cruising about the eastern end of the Mediterranean. Such a vessel would be rigged with a square-sail or a lateen sail (sometimes) on her foremast, and a lateen sail (resembling that of the familiar dhow) on the two others. Although nautical terminology was very much confused during the Middle Ages and frequently the same appellation was given to quite distinct types of craft, yet we shall not go far wrong if we describe this new development of the big Mediterranean ship as the carrack. She was destined to play an important part in the world's history, so that she is worth remembering, although at first she was little more than a very unwieldy, clumsy creature, which must have been very slow in a light wind and a great source of anxiety in bad weather.

It was hardly to be expected that this new fashion of Englishmen sailing in English ships to the south would not cause some modification in our naval architecture. One of the characteristics of the southerners was their addiction to the use of fighting-castles or platforms which they added even to their merchantmen, and from which they could hurl down destruction on the attacking pirates. Even in classical times a merchant ship carried sometimes as many as eight of these towers, which could be easily erected and as easily taken down again when danger was passed. On ships of the galley type they were still more in evidence until very late in history. Therefore these towers must have made some impression on the minds of the Englishmen, for not very long after we find them added to the English Viking-shaped ships, of which there is much historical pictorial evidence. In the bows of the ship was built one of these towers, and by this means we obtain the origin of the word "forecastle" in our language as denoting the fore-end of the vessel. A similar castle or tower was also placed at the stern, and thus, while some of the crew overhead were busy hurling their darts at the enemy, the steersman could do his work with some shelter, sitting under the arched roof of the turret. This new southern idea grafted on to the northern hull was the beginning of a considerable alteration in the shape of our vessels. We shall not, in fact, be guilty of overstatement when we remark that here was the germ from which came a completely new development of naval architecture.

The change proceeded in the following manner. At first the "castle" was merely a raised platform, no part of which projected ahead or astern of the ship; then, the utility of this innovation becoming recognised, the structure was developed so as to project considerably outside the hull. From being at first a mere light scaffolding, the "castle" gradually became a permanent rather than a temporary modification of the ship, and so in course of time the design adopted in contemporary naval architecture was altered to meet this novel institution. Thus the old shape of the long Viking ships changed until they became broader to support these "castles" more easily, and the ends of the ship gradually swept up to meet these additions. Finally, instead of these platforms extending beyond the extremities of the vessel, they became an integral part of the hull itself, and at the same time were lowered to unite with the body of the ship.

Such roughly, in outline, is the manner of the development of the ship during the period we are discussing. It is essential to bear this in mind, for even when we come to the later time when the wooden walls of England were the talk of the world, such ships were still merely the Viking craft considerably enlarged and vastly modified by the prevailing ideas of other nations and the previous historical evolutions. Shipbuilding, like all other arts, is one long chain of development, whose links during different periods change in character and size. And of these links by far the most important was that which connected the later ships with those fine double-ended craft of the Norsemen.

But apart from the change which the "castle" idea wrought in mediæval ships, there were other alterations which followed as the outcome of experience in the ways of the ship. Fighting-tops were added to the head of the mast. From this position picked archers could deal destruction on the steersmen and commanders of the opposing ships. The mast was supported with rigging coming down to either side of the hull abaft amidships, and there were forestays and backstays for further strength. Braces, of course, led from the extremities of the yard, and sheets from the bottom corners of the sail. The first improvement in steering seems to have been effected by working on the method we saw exhibited in the Viking ships. Thus the rudder, whilst still supported at the side of the ship, was held by a bracket which projected the steering-oar clear of the hull, a tiller being connected at the top and leading in to the steersman. Winches with wooden drums and worked by handspikes were employed, at any rate in the thirteenth century, for getting up the anchor.

Those readers who may be familiar with the Norfolk wherry will remember that in fine weather she increases her sail area by lacing on an additional piece of canvas, called a bonnet, along the foot of the sail: when the wind increases this can readily be detached, and its disuse is equivalent to taking in a reef. This is a survival of one of the very oldest features of the northern sail, and was much in use during the Middle Ages both in England and Scandinavia. Had we been able to witness a thirteenth-century vessel setting forth from the land, we should have noticed in her a more full-bodied ship than the old Viking type. With her "castles" and fighting-tops she might have seemed to be more top-heavy, but there was a greater beam and displacement to make her seaworthy. She was beginning to become not merely a ship but a battle-ship, and the final stage in her development will probably never be reached as long as there is any need of her services. The need not merely of individual ships but of a defending navy was being realised, and the work of the Cinque Ports—originally five in number, but afterwards added to—was in some way what Portsmouth, Chatham, and Devonport effect to-day. As soon, therefore, as the ship began to be reckoned seriously as a fighting unit for the defence of her country, her size was bound to increase; for the more men she could carry, so much more damage could she shower on the enemy from bows and engines of war.

Thus the old "single-sticker" became a two-masted ship, for as the size of the hull increased so also would the sail; and even with a large crew on board there is a point reached when the area of canvas in a single sail must be restricted. Even at a slight loss of speed, handiness insists on splitting up the dimensions of the canvas. When English sailors had seen this arrangement in the large ships of the Mediterranean, it was only a question of time for our country to

Ships of the Thirteenth Century

The bonnet, or addition, is seen laced along the foot of the sails; The forecastles, stern-castles, and fighting-tops will be readily noticed.

follow the example thus set. At the same time, as early as the fourteenth century, another important change was made by taking the rudder from the side and placing it right aft in the position where it has remained ever since, and the tiller, instead of coming in to the ship at right angles as it had for so many centuries, was now in line with the keel as it is to-day. Trade was being opened up not merely between England and the Mediterranean but between the northern shores of the Continent and ourselves, so that there was the greatest encouragement to build ships which could carry large quantities of merchandise and make their ports in safety and with despatch. In the time of Edward I., for instance, there was a considerable trade in wool carried on between Flanders and England. Attention was paid to maritime legislation, the seafaring life encouraged, and the experience of long voyages was being put to practical use by the rigger and shipbuilder. At the same time the progress of the ship was constantly being delayed through the internal troubles of the country. There is nothing like a civil war for staying the advance of shipbuilding. It was so, later in history, in regard to the Civil War in the United States of America, which cost that country a supremacy which she might have had in the world's shipping, and thus allowed Great Britain to make up for lost opportunities. And it was the case also when the Wars of the Roses not merely stopped foreign trade, and therefore the need of ships, but prevented the shipman from following his calling through the demands for his service ashore.

At the same time that our nation was wasting its energies in futile strife, other European countries were going ahead with their maritime development. In the north the seaport towns of Germany and the Baltic had banded themselves together for mutual trading interests into what was known as the Hanseatic League. Totalling at length no fewer than eighty-five towns that included Hamburg, Lübeck, and Amsterdam, this grew into a most powerful organisation during succeeding centuries, and to them is due a large share of praise for the development of the ship in Northern Europe during the Middle Ages. It is interesting to state, as showing the extraordinary prosperity to which the Hanseatic League attained, that the London agency of this mercantile association existed until quite recently, and their offices were only demolished when the space was required to build the present Cannon Street Railway Station.

In Southern Europe, too, Genoa, Venice, and Naples had continued to flourish, not merely in trade but in the creation of ships of considerable size. Profiting by the lessons derived from these, the inhabitants of the Spanish peninsula had also created for themselves fleets of large, powerful vessels, and England was well behind in the race for the prizes which can only be obtained through ships. Already, by the middle of the fourteenth century, the Canaries had been discovered by the Portuguese. Presently Madeira and the Azores were to be discovered also, and Vasco da Gama astonished the world by his memorable voyage in which he doubled the Cape of Good Hope and got as far north as Zanzibar.

All this time British shipping had considerable leeway to make up, but as soon as domestic affairs began to quiet down again, the advance of overseas trade—and so of shipbuilding—went on again. London was our chief port in the fifteenth century, but Bristol, by reason of its proximity to Ireland and by the fact of its being somewhat nearer to the Mediterranean, had succeeded in building up for itself considerable prosperity. During the reign of Henry IV. commercial treaties were made with the Hanseatic League to the encouragement of shipping, but the North Sea was as dotted with roving pirates, lying in wait to devastate both peaceful fishermen and merchantmen, as ever the Mediterranean had been when the richly laden carracks from Genoa and Venice made such handsome booty.

Vessels were growing in size to such an extent that we find among those which were English-owned the *Jesus* of 1000 tons, the *Holigost* of 760 tons, and others of five and six hundred tons. Even if we make allowance for the difference in tonnage measurement between those inaccurate times and to-day, yet we have here evidence of ships of no mean dimensions and carrying power. The tendency of naval architects, if we are to judge from the pictorial examples of craft which have survived, was to make the vessels with so much sheer as to be almost crescent shape, the object aimed at being no doubt that the vessel might be able to run before a following sea without being pooped, and at the same time the high bows were a protection when meeting a head sea. In France and the Low Countries the design of the ship, though modified considerably, was still reminiscent of the Viking vessels; but they had become ships instead of long open boats. Their sides were built up, their proportions were more "tubby," and instead of the planks being laid on the frames so that the vessel was clinker-built, they were laid edge to edge or carvel-built, as most vessels above the size of small rowing-boats are now made. At the same time, there are not wanting illustrative evidences showing these carvel-ships fitted with rubbing-strakes which ran round the entire hull from bow to stern, so that when alongside a quay, or—more necessary still—when fighting an enemy and the ships crashed alongside each other, the hull might have some protection from being indented. By day flags were flown from the mast-head and the stern, but gradually the practice came in of carrying a flag at almost every angle of the ship where this could be done. The introduction of ships' lanterns for manœuvring at night dates as far back as the time of the Romans. In England during the Middle Ages the lantern on the admiral's ship, hanging over the poop, showed the other ships the lead to follow during the darkness.

But in addition to the new inventions which we have mentioned as affecting the development of naval architecture, there was destined to be yet another important innovation, which was to cause a considerable alteration in the ship's appearance, before the close of the fifteenth century. This was the introduction of cannon. As long as the combatants had been content to shoot arrows and throw darts at each other, to hurl heavy weights from the eminence of their fighting-tops, to come alongside and board each other, practically the same tactics continued that had obtained ever since early classical times on the Mediterranean. But the introduction of cannon on board ship, though it was a long time before seamen realised how much they meant, could not fail to alter entirely both the fighting methods and the arrangement of the ships which were called upon to carry out the strategy decided upon. When first guns were employed on board ship, they were fired over the side from the deck. Then it occurred to the authorities responsible that if these were placed on a lower deck, and holes were made in the ship's sides through which to fire, the men would be less exposed to danger. But the deck above could be utilised for cannon also, thus providing two lines of fire instead of one, and in this case the men could be hid by means of cloths running round the vessel's sides. In course of time, as every one is aware, the number of tiers of guns increased. But in order to be able to withstand the shock of firing the guns and their additional weight, it became necessary to increase the beam of the ship and to strengthen its construction very considerably. It is quite evident that with so much weight placed so high up from the water, unless greater width had been given, the vessel would have been almost top-heavy, and in a sea-way would have been positively dangerous.

By about the end of the fifteenth century the ship was growing out of experimentalism into something more capable of being trusted and made use of. For centuries, in spite of occasional set-backs of varying periods, shipbuilding had been progressing—not scientifically, but yet progressing. We ourselves were about to become a great naval nation. It was all very well for our ancestors in a century so early as the time of John to claim for England the title of "Sovereign of the Seas," but when even at that time some of the vessels of Italy and the south-west of Europe were far superior to anything we could build, it was a boast that could not possibly be defended. But next to being able to introduce something new comes the ability to recognise the superiority of other people's designs. In the matter of ships England did this again with regard to Mediterranean, as she had done in respect of Scandinavian types.

CHAPTER V

THE SHIP DURING TUDOR TIMES

TO the enterprise of Henry VII. and to his encouragement we owe the beginning of our modern English navy. As already noted, the Wars of the Roses had caused maritime matters to be neglected considerably. Henry V. had increased the number of ships ready for service, but on his death the thirty odd ships that remained were sold out of the service, and by 1430 the British navy consisted of two or three dismantled hulks.

There was, therefore, great need for a change in the administration of our naval defence, and to the Tudor sovereigns, especially the two Henrys and Elizabeth, must be given thanks for the work they performed at a crisis of our naval history. Henry VII. built the *Regent*, a vessel of 600 tons, which carried no fewer than four masts, her foremast and mainmast being square-rigged, but her main mizzen and her bonaventure mizzen being rigged with a lateen sail each, like the Mediterranean ships previously alluded to. She had also a topmast on her fore, while her main carried both topmast and topgallant-mast, though neither of the two others had topmasts. Besides these she had a great spar, which was a cross between a mast and a bowsprit, extending from the bows, on which was carried a square-sail called a sprit-sail. On her maintop-gallant-mast she set a triangular sail with the apex at the top and the base at the bottom, but it had no yard, the foot setting along the yard of the topsail below. From this brief description the reader will be able to gather some idea of the rig which now was beginning to dominate the big ships of this period, and to see how great an advance had been made since the old Viking days. A similar ship, though somewhat smaller, was the *Sovereign*. From the statement that she had a couple of decks in her forecastle, two in her topgallant poop at the stern, and that even above these two latter there were a couple more, it will readily be seen that the custom, which was so prevalent during Tudor times, of raising the stern of the ship to absurd and unnecessary heights, had already begun.

The reader will not fail to bear in mind that the smart distinction which to-day exists between the ships of his Majesty's navy and those of the mercantile marine had, in the time we are speaking of, not begun to exist. Sometimes the king let out on hire his royal ships to merchants in times of peace; sometimes, on the other hand, merchant vessels were used to aid the royal ships in time of war. As to the rigging of these ships in the early Tudor times, we have already mentioned that on her main and foremast would be set square-sails, while topsails and a topgallant-sail above were already known. For reefing, the bonnet laced on the foot of the square-sail would be taken off. The rigging supporting the mast was led through dead-eyes (wooden blocks pierced with holes), through which the lanyards of the shrouds passed, in much the same way as in many of the sailing ships of to-day. Pulleys were already employed; sand-glasses and logs for calculating a ship's speed through the water, marline-spikes, binnacles, and many other articles of a ship's furniture, were already in regular use, as we know from existing documents which have happily been preserved. When fighting, the rows of wooden shields running round the ship's side, and decorated with the admiral's coat of arms, were used for protection of the gunners, and later still further protection was added.

Portsmouth was springing up as a naval dockyard, and there the first dry-dock was built about the time when Columbus set forth from Spain, in his caravel *Santa Maria*, on his memorable voyage which led to the discovery of the West Indies. A caravel was really a small edition of the carrack and was essentially of Mediterranean origin. But Columbus's ship, with her three masts—being square-rigged on both fore and main but with lateen on her mizzen—was both slow and a bad sea-boat. She carried but one topsail, above her mainsail, and no others except the square sprit-sail set across and below the bowsprit. About the time of the Chicago Exhibition the American authorities sent over to Spain and inquired if by any chance the plans and specifications of Columbus's ship were still in existence. Search was accordingly made in Cadiz dockyard, where the necessary documents were discovered among the archives, and she was then rebuilt, actually timber for timber, bolt for bolt, as she had been four hundred years before.

One who happened to see this replica vessel before she sailed across the Atlantic, Commander E. Hamilton Currey, R.N., then in command of a British gunboat which was lying but half a cable's distance from the *Santa Maria*, remarked to the present writer on this strange sight: "I may say that great as my respect for Columbus had always been, it was greatly enhanced when I saw the thing, like half a man's tall-hat case, in which he sailed out into the unknown."

During Henry VIII.'s reign the famous *Great Harry* was built, a big four-masted ship carrying both topsails and topgallant-sails on three of her masts, and a topsail on her bonaventure mizzen (as the aftermost mast was always called). These were, of course, in addition to the other sails or "lower courses" carried as well. But such a ship as this was the exception rather than the rule. It would be as untrue to say that in the beginning of the twentieth century the *Dreadnought* was typical of the British navy as it would be to affirm that the *Great Harry* was a fair specimen of the warships in the first years of the sixteenth century. But as the *Dreadnought* has created a type to be followed subsequently, so the *Great Harry* was an example for other shipmen to follow.

An important step was taken by Henry VIII. when he made the navy no longer a mere auxiliary of the army, but a separate force capable of being organised apart. Increased numbers of vessels were built, and the Hanseatic League, previously mentioned, sold some of its fine ships to swell the English lists.

We can picture very accurately, from existing data,

The "Santa Maria" of Columbus

At the end of her long voyage, nearing the western shore. From the deck of this vessel Columbus obtained his first view of the islands of the western hemisphere.

what one of these early Tudor big ships must have been in reality. Painted green and white—the Tudor colours —with her white sails bellying to the wind, with her biggest ship's boat towing astern (as was customary); emblazoned with the admiral's arms, she had nettings spread over the ship's deck to catch falling spars and missiles when in action; but in celebrating a triumph, was covered in and curtained with rich cloth. There were pennons flying above the forecastle and at the two corners of the castle, and two square banners amidships, whilst above the rudder, high up on the stern-castle, was a large square banner, much greater than the rest, and a broad swallow-tailed standard flying from the maintop. She must have presented a most striking sight, even if she rolled and pitched in a sea-way, was a brute to steer, and sailed no nearer than eight points of the wind.

Nor were the Elizabethan ships much better. They were clumsy, with a length about three times their beam, built up far too absurdly at both bow and stern, with a complete gun-deck running the length of the ship below the upper deck, but batteries of guns also in the towering poop decks at the stern, as well as in the great square forecastles. Between the poop and the forecastle was a space called the waist, but the bulkheads of both forecastle and poop were fitted with guns which, in the event of the ship being boarded, could be most readily used, the guns here being, of course, only quick-firers. Under the poop decks were the quarters of the master—who was responsible for the sailing of the ship as long as she was on the high seas—and the captain, who was not, strictly speaking, a sailor, but responsible for the discipline of the whole ship's company. The steering arrangements were also in the stern, but the steersmen were not able to see how the ship was heading. Instead, they had merely to obey the orders shouted down to them by the pilot through a hatch from the deck above.

Below the upper deck was the maindeck, where the heavy guns were placed, some of the men berthing here and others in the forecastle. Below this deck again were kept the ship's stores, the powder magazines, beer, water, and provisions. A great deal of valuable space was wasted by the gravel ballast which was carried on board in baskets. The "cookroom" or galley was for a time placed below, but great complaints were made of the heat and smell which necessarily arose therefrom, and in some ships it was placed in the forecastle.

We referred above to the change in naval matters which had ensued as the result of introducing cannon on board ships. We shall have reason again to mention this innovation here in noticing the development of the ship in the sixteenth century. We mentioned also that in the Mediterranean the craft had developed along two separate lines—the galley and the round-ship. As time proceeded it was found that neither of these types was perfect; there was something lacking in both, and each had the defects of its virtues. For instance, the galley was easy to manœuvre as she had always been, and for that reason was a very useful unit in war. At the same time she was of low freeboard, not much of a bad-weather craft, and unfitted for long ocean passages. The round-ship, on the other hand, was slow, but able to hold her own in gales of wind. In light winds the galley was able to run rings

From a photo by *Hanfstaengl*

A NAVAL ENGAGEMENT OFF GIBRALTAR IN THE EARLY SEVENTEENTH CENTURY

This illustration, which is reproduced from a picture by Vroon, the celebrated Dutch marine artist of that time, may be regarded as authentic. In the foreground will be seen two typical Mediterranean galleys of the same period. The one on the right has been run down by a galleon.

round her. Her very ponderousness became a positive hindrance to her fighting qualities. Therefore European shipmen were driven to realise that what was wanted was such a vessel as would to some extent include the virtues of both of these separate types, with as many of the defects as possible eliminated. As a result the galleon type of ship was introduced. In reality she was a compromise, as every kind of ship always has been and always will be, for one reason or other. She had a length of three times her beam, with a long flat floor, a freeboard greater than a galley, but not so lofty as in the case of the big carracks engaged in carrying merchandise. In the vessels of this type but of superior tonnage the galleon had at least two, and sometimes three decks.

But the galleon was found also to be not entirely satisfactory, and from her was evolved the "great ship" or "ship of the line," such a vessel as was capable of bearing the brunt of fighting, and able both to carry on and endure severe combat. By the year in which the famous Armada came sailing up the English Channel, this "great-ship" type was established. Her example was followed for succeeding centuries, and found its fullest expression at the battle of Trafalgar. Though lacking the mobility of the galley, she was able to keep the sea in all weathers, and to carry large quantities of provisions and war-stores, though, but for the reckless waste of space in the arrangement of internal fittings, she should have been able to carry very much more. This "great-ship" type had been a long time discovering her own particular functions in naval warfare. Previously, as the reader is already aware, the method of sea-fighting had consisted in getting alongside an enemy, becoming locked together, with shear-hooks extending from the yards, in the shape of scythes, to cut away his rigging if possible, and pouring large numbers of men on board to fight hand to hand. But the invention of cannon altered these tactics, though very gradually. At first, while "boarding" remained the typical method of warfare, cannon were used merely as an auxiliary to this end. They were highly serviceable in crippling the ship at short range, until she was so weak and helpless that she could be boarded with the utmost ease.

But in process of time the power of the cannon gradually began to be appreciated. The principle of boarding was dying out, and the ship began to be regarded in her modern aspect as more of a large floating fort, capable of effecting destruction from a greater distance. Whereas the chase-pieces in the bow and stern had afforded her chief opportunities of showing the value of cannon, during the sixteenth century the true import of being able to deliver a powerful broadside fire came to be recognised, and as early as 1574 it was a well-known tactic in our navy, the idea being to aim low down with the guns placed in the lowest tier, and so smash the enemy's hull.

As we know from existing State documents, Elizabethan ships were armed with various kinds of guns, which included heavy muzzle-loaders of brass or iron having a long range, shorter-range guns, quick-firing breech-loaders, "harquebusses," of which a 400-ton ship

Queen Elizabeth's Royal Ships

They were strong, well-armed, and, for the period, comparatively good sea-going vessels They were sent to sea with complete inventories, and were carefully overhauled and refitted at proper periods.

carried as many as eighty, and in addition also bows, pikes, arrows, and bills, as well as murrions and "corslettes" for use as personal armour. It is impossible to give here in such limited space the entire equipment, fascinating in interest though the description of it would be. As one wades through the manuscript records which contain the inventories of almost all the vessels of the Elizabethan navy, one can picture the individual ships rising up before one's eyes in entire detail. But our task is not so much to show the growth of shipping in one particular period, as to outline its development and change through successive periods of the world's history.

Improvements in shipbuilding had been seriously and carefully considered by the English naval authorities, and there is no question that Elizabeth's royal ships were fine, staunch vessels, and superior to many of the merchantmen afloat. At the same time, these improvements would not have come except as the result of constant and continuous experience in voyaging over the sea. There was great inducement to follow the vocation of a seaman. Companies of merchant-adventurers were despatching vessels, fitted out at their own expense, to open trade with Russia and other countries. Explorers were sailing away across the Atlantic, and returning after many months with reports of their discoveries and plenteous rewards for their daring and enterprise. The men from Cornwall and Devon had found the fishing off the Newfoundland Banks, though a long way from home, highly remunerative.

But besides these legitimate opportunities for enterprise, we must not forget to mention that very profitable occupation which went on at this time and was known as privateering and buccaneering. If we examined into the morality of this profession we might find some reason for criticism. The fact that Raleigh, Drake, Hawkins, and other distinguished English sailor-men took a prominent part therein makes the exploits to possess a distinction high above that of mere petty piracy. Indeed, until the time of James I., and even later, they were tacitly permitted by the English Government, and the lax spirit of the age lent them encouragement. Looking at this pursuit merely historically, we cannot deny that buccaneering did much to develop not merely seamanship but the personal qualities essential for an efficient navy. The temptation held out by the treasure-ships from the Spanish and Portuguese colonies in the New World, returning home heavily laden with their rich tonnage, was too much for the adventurous spirit of English seamen, and the encounters between British buccaneers on the one hand and Spanish treasure frigates and carracks on the other make some of the most exciting reading to be found in the world's history.

We spoke just now of the galleon. So much confusion has existed in many minds for so long a time, that it may not be out of place to give here the results of the most recent researches into her real characteristics. First of all let us remember that a galleon was not necessarily a ship belonging to the Spanish nation. England possessed galleons long before Spain. She was the Spanish equivalent for the Elizabethan "capital" ship, and was a descendant of the caravel, but somewhat

Spanish Galleons

The galleon was an improved caravel, measuring in length three times her beam. The Spanish galleons were built of considerable strength, but were very clumsy and badly constructed.

bigger. Now, the length of the caravel on the keel was twice that of her beam, and her height was never to be more than one-third of the keel. Her total length, including the rake of the bow and stern, was equal to the combined keel and beam. The caravel had no internal lining, and her masts consisted of single spars and were very long.

The galleon, then, was an improved caravel. She was in length three times her beam, and had her birth in Italy. The Spanish galleons were built unnecessarily strong, drew far too little water, would not sail near to the wind, and were so badly constructed that they leaked abominably. After the sad lessons learnt through the series of disasters which befell the Armada in 1588 the Spanish galleons were improved, Royal Commissions were appointed to report on Spanish shipbuilding, naval experts gave careful study to the art of making ships, and embodied their knowledge in learned treatises. After a time the galleon became a better ship, and the previous fault of giving her too short a keel was remedied. There is a record of a galleon, called the *San Josef*, being built whose length was 115 feet on her keel, while the length of her gun-deck measured 139 feet, her beam being 40 feet and the depth of her hold 19 feet. Her tonnage is given as being over 1109 tons; but the tonnage of those days was singularly unreliable. By the year 1708 the galleon had died out altogether.

It must not be thought that the galleon or the great-ship were the only principal ships of the Elizabethan period. A highly important type of vessel was the pinnace—not the smaller craft, which was really a ship s boat, but a flush-decked craft of about fifteen to eighty tons, with three masts, carrying a square foresail on her fore, a square mainsail and topsail on her mainmast, while her mizzen-mast set the usual triangular lateen sail. When two or three ships journeyed together in the voyages of exploration during Elizabethan times, we frequently find that a pinnace was one of them. She carried a bowsprit on which she set her sprit-sail, like the galleons and great-ships, but she was far more handy, possessed a greater speed, and was more reasonably designed than those huge monstrosities which had become notorious during this Tudor epoch. Another characteristic type of this time was the galleass, which was a kind of galleon, but was also rowed when necessary with enormous oars, for which purpose a large number of slaves were carried. Among the ships which formed the Spanish Armada these vessels are mentioned as being of such tremendous dimensions as to carry chapels, turrets, pulpits, "and other commodities of great houses."

But even before Spain had discovered the failings of the galleon type of ship, England had realised that the "over-charged" or exaggerated built-up sterns and bows were a disadvantage rather than otherwise. In such vessels as had these defects, alterations were made so that the curve of the sheer was far less pronounced and a more level line marked the "run of the ship's" body. But there still remained at the bow a powerful beak, which extended some distance outboard ahead of the hull, and when it plunged into a head sea must have caused a great deal of unnecessary friction and materially hindered the vessel's progress. Ship designers and builders were still floundering about in ignorance, but they were almost beginning to see the light of science in their work.

CHAPTER VI

THE SHIP IN STUART TIMES AND AFTER

WHEN the coast-line of England was threatened by the invasion of the Spanish Armada, the royal ships had been assisted by a number of our merchant craft, and as giving us some idea of their size it is opportune to mention that they averaged little more than a hundred tons each, though at the same time allowance must be made for those big-bodied craft which were away exploring or on fishing expeditions in far-off waters.

But with the great enemy of England now smashed, or at least crippled, there was a freer opening for the development of the merchant ship. The Dutch were the great sea-people at the beginning of the sixteenth century, and before long it was evident that England would have need to contest with them the right to be mistress of the seas. But before that, and as early as the year 1600, the formation of the East India Company, which was to be the first step in securing for us the vast Indian Empire, gave a powerful impetus to mercantile shipping. For so long a passage round the Cape of Good Hope and across the Indian Ocean it was essential to have as fine vessels as could be obtained. To carry the cargo which was to pay for the building, fitting out, and the wages of the crew, she must also be capable of stowing a large amount of tonnage in her holds. Thus a ship named *Trade's Increase*, of 1100 tons, was launched in 1609 and sent on her way, and was the largest merchant vessel that had so far been built. The sensation, indeed, which her appearance caused at that time must have been analogous to that which the coming of the *Lusitania* and *Mauretania* aroused in our own time. Unhappily, an accident befell this fine ship while she was being repaired abroad. She fell over on to her side, and was burnt by the Japanese. But other vessels were more fortunate, and the earnings of these ships on the Indian route amounted to nearly 340 per cent. It is hardly surprising that so highly remunerative a speculation encouraged both merchants and builders to send to sea the best ships they could fashion. During this seventeenth century the ships of both the royal navy and the mercantile marine increased in size, though not on the foolish lines that we discussed in the previous chapter.

A 1200-ton ship called the *Prince Royal* was laid down in 1608, being the largest and finest man-of-war in her time. She was designed and built by Phineas Pett, whose family, from the time of Henry VIII. until the reign of William and Mary, distinguished itself by wonderful skill in naval architecture and construction. The launching of this ship caused considerable excitement at the time, and from a manuscript diary happily still preserved, written by the same Phineas Pett, I am able to give some details which may not be without interest. It is a quaint document, containing an amusing mixture of his own domestic affairs and naval matters. By September of 1610 the progress of building the *Prince Royal* had advanced so far that everything was ready for launching, and Pett himself was busy to see that all the arrangements were complete for the reception of the royal personages who were coming specially to see the big ship take the water. A royal stand had been erected in the most convenient place in the shipyard for his Majesty, the Queen, and royal children. Every detail was so closely studied that, to quote Pett's own words, "nothing was omitted that could be imagined anyways necessary both for ease and entertainment."

On Sunday evening of September 23, very late, a messenger came to Woolwich bringing a letter to Pett, ordering him to be very careful to search the hold of the ship lest "some persons disaffected might have board some holes privilly an' the ship to sink her after she should be launched." But Pett was far too wide-awake not to have foreseen any such possibility. On the Monday morning he and his brother, with others of his assistants, opened the dock-gates and got everything ready for the approach of high tide, when the vessel was to be sent into the water. But unfortunately the wind blew very hard from the south-west, so that though it was a spring-tide (when the tides usually rise higher) the wind kept back the flow so much that it was scarcely better than a neap-tide. Here was a pretty state of things, for the King and his retinue had already arrived in the royal barge to witness the launching, while the tide seemed likely to fail the shipbuilder just when he needed it most. So, taking the only possible chance remaining to him, about the time of high water Pett had a great lighter made fast at the *Prince Royal's* stern, hoping that thus this part of the ship would be floated. But unhappily the wind "overblew the tide," although the ship actually began to move; then "the dock gates pent her in so streight that she stuck fast between them by reason the ship was nothing lifted with the tide as we expected she should, and ye great lighter by unadvised counsel being cut of, the sterne of the ship settled so hard upon the ground that there was no possibility of launching that tide." Besides which, so many people had gone aboard and crowded the ship that they could hardly turn round.

Something of the modern ceremony of naming the ship at launching was about to take place, for, proceeds Pett, "the noble Prince himself," accompanied by "ye Lord Admirall and other great Lords were upon the poope, where the standing great guilt cupp was ready filled with wine to name ye shipp so soon as she had been on floate, according to ancient custome and ceremonyes performed at such time by drinking part of the wine, giving the ship her name, and heaving the standing cup overboard." But alas! the *Prince Royal* was destined not to be launched that day. "The King's Maj^tie^," adds Pett pathetically, "was much grieved to be frustrate of his expectation, coming on purpose, tho very ill at ease, to have done me honour, but God saw it not so good for me and therefore sent this cross upon me, both to humble me and make me to know that however we purposed He would dispose all things as

He pleased." So at five o'clock the King and Queen departed.

When every one had gone, Pett and his assistants set to work "to make way with the sides of the gates," and plenty of help being at hand, got everything ready before any flood came up. The Lord Admiral sat up all night in a chair in his chamber till the tide "was come about the ship." It was a little past full moon—when the tides are at their highest—and the weather was gusty, with rain, thunder, and lightning, when Prince Henry came back again and went aboard with the Lord Admiral and Pett about two o'clock in the morning, or an hour before high water. The *Prince Royal* was then launched without difficulty or any straining of screws and tackles. As she floated clear into the channel the Prince, after drinking from the cup, solemnly named the ship the *Prince Royal.* Most beautifully decorated with carvings and paintings, double-planked, with an elaborate figurehead at the bows representing her namesake on horseback, the *Prince Royal* carried fifty-five guns, three lanterns at her poop, and will always be a memorable landmark along the pathway of history.

The Sovereign of the Seas, also designed by Pett, and launched in 1637, was another epoch-making ship, and is interesting as being the first of the three-deckers. Originally this ship was a four-master, but later she was cut down a deck and her masts diminished by one. In this type we find a certain amount of permanence, for the famous English warships which, under the nickname of "wooden walls," were later to win so much admiration, differed comparatively little from such a vessel as this. Thanks to Dutch influence, not merely were big ships being built, but various kinds of smaller craft were being constructed. Of these we may mention the *sloepe*-rigged craft with two masts and a fore-and-aft sail on each (like a modern schooner, but without any triangular headsails), yachts rigged with a mainsail resembling that of a modern Thames barge, and triangular headsails like our jibs, but the old-fashioned topsail as carried on contemporary full-rigged ships. An important type, also, that was evolved about this time was the bomb-ketch, which had a couple of masts, the bowsprit having the usual sprit-sail, the mainmast being square-rigged as in bigger ships, and the mizzen having the usual lateen sail with a square topsail above. The most noticeable feature of this craft was the large space that was left between the mainmast and the bows. This was done in order to afford plenty of room for firing the mortars with which the ship was supplied.

The fore-and-aft rig, as we can see from early prints and paintings, had really begun to show itself towards the end of the sixteenth century. There were reasons for adopting, in the case of small craft, a rig that was less clumsy and needed fewer hands to work than was demanded by the ship with its yards and courses. There is no doubt that at any rate by the date just mentioned there were small coasters rigged with just one sail resembling that of a Thames barge of to-day, having a spar (called a sprit) stretching diagonally across the canvas, the mast being stepped so far forward in the bows that headsails (jibs) were not required. But, as any one with practical sea experience can easily guess, this type was soon to be modified, for in a breeze such vessels must have "griped" and have possessed an almost uncontrollable tendency to rush up into the wind. The rig of the Norfolk wherry to-day is practically that of the first North European fore-and-afters, with one exception—that the wherry has a gaff, whereas the sixteenth-century craft possessed a sprit instead; and the defect so noticeable in the Elizabethan coasters is essentially the great vice of the Norfolk Broads wherry. So gradually the mast in the seventeenth century was brought farther aft, and triangular jibs and foresails were introduced, though in Holland the new rig had been thoroughly established before the close of the previous century. In course of time the sprit was done away with and a gaff was given to the mainsail, and presently a boom, so that it might set better. But the old square topsail with its yard, as on a full-rigged ship, remained, as also a topgallant-sail, set above it in like manner. Because of the shallowness of many of their waterways the Dutchmen could not allow their ships to draw very much water, and so the use of lee-boards was brought in, by which the depth of the ship could be increased for sailing better in deep water. Even up till to-day the Dutch cutters and sloops have altered scarcely at all since the seventeenth century, and the familiar Thames barge is in many respects a modified Dutchman adapted for the special purposes of the lower reaches of the Thames and Medway.

It was the Dutch, then, who possibly invented the

A Seventeenth-Century Dutch Yacht

It was the Dutch who built the first yachts, and in 1660 presented our Charles II. with the first yacht ever seen in English waters. In the design of her hull the yacht retained many of the features of the contemporary big sailing-ships.

fore-and-aft rig, but most certainly developed it. In 1660 they presented our Charles II. with the first yacht ever seen in English waters, but her high stern, beautifully decorated and carved after the manner of the time, and her massive appearance generally made her to be an entirely different being from the kind of vessel which to-day is known as a yacht, though here was the true beginning of the "queen of sports." From this high-pooped yacht type of vessel developed the famous Revenue cutters of the eighteenth century. In this same eighteenth century also was developed in Ireland, and later in England, a keen interest in the new sport, and by the beginning of the nineteenth its popularity was assured, so that in the present twentieth century it has made wonderful strides in every way.

But to return to the point at which we digressed. The reader will remember that mention was made in the previous chapter of the galleass. Now its successor appears in the seventeenth century as a frigate, whose exact form was some time in settling itself. What was desired was a capable deep-sea ship, but something lighter, faster, and handier than the bigger vessels. Thus, as an attempt to satisfy these requirements the frigate was evolved, and she was given finer lines below the water, her keel was made long, and, unlike the ships of the line, she did not rise to a great height above the water. It will somewhat clear the mind of the reader if we here take this opportunity of separating the main types of ships thus: First of all, the "capital ship" or "ship of the line" was the backbone of the fleet, which had to stand and give the hottest fire. She had descended from the "great-ship," which in her turn had sprung from the "galleon," which, again, as we pointed out earlier, was a fusion of the galley and the carrack. Thus the "capital ship," which was a seventeenth-century expression, was the forerunner of our modern battleship. Now the galleass, which was propelled with oars and sails, developed into the frigate, and as such became the precursor of our modern fast cruisers, whilst the sea-going pinnace of the time of Elizabeth became in the eighteenth century the corvette.

The conflict which was bound to occur between the Dutch and ourselves as rival naval powers occurred at last, but under Blake the enemy was beaten and our navy rose to the highest place among sea-nations. The Dutch had, however, been in advance of us in naval architecture, which was now fast becoming a science, and from the prizes captured we learnt a number of lessons which were not forgotten, even though the same enemy later on, owing to our negligence, were allowed to sail up the Medway and burn our ships. But the fine English character which had been so brave and valorous in Elizabethan times had somewhat decayed. Discipline in the navy was slack, and there was considerable bribery and corruption rampant both ashore and in the dockyards and administration, and afloat among the officers and crews themselves. Meanwhile the French were becoming exceedingly proficient in shipbuilding, and their *Soleil Royal* and *Royal Louis*, of 1940 and 1800 tons respectively, were magnificent ships of the period; but the

Royal Charles, a fine four-masted ship built in 1672, showed that British shipbuilding was still far from dead. And here let us stop for a moment to fix in our minds what a late seventeenth-century full-rigged ship resembled in her prime. The *Royal Charles*, for instance, a three-masted vessel, must have made a fine sight with her gilded ports, topsails and topgallants, her timber-coloured hull relieved by a band of blue, with the Union-jack flying forward and her ensign at the stern. The long, raking bowsprit was still there, and the sprit-sail which set from below it, but by now there was added also a sprit-topmast at the extremity of the "boltsprit," and up this smaller spar was hoisted a sprit-topsail, being also square in shape. It was above this sprit-topmast that the staff for the Union-jack was fixed, and, as every one knows, the ships of his Majesty's navy still wear the jack in the bows, but inboard, since bowsprits have long since disappeared.

We have already referred to the introduction of the triangular headsails which had been made for smaller craft rigged as sloops or cutters. Now, by about the commencement of the eighteenth century this shaped headsail is also added to Dutch full-rigged ships, the old sprit-sail set below the bowsprit still remaining as it had from the time of Columbus and earlier. Then gradually the new shape spread to France and England, and still other sails of the same shape were added to fill in the gaps between mast and mast. These were main and foretopmast staysails. Then with the advent of the triangular sails on the bowsprit, of course, it could not be long before the sprit-topmast disappeared, for it was only in the way, and it is surprising that the jack-staff still remained at the end of the bowsprit, where it must have frequently got foul of the jib. But no doubt it was taken in except when at anchor.

There is still another important alteration which was made at this time of the eighteenth century which cannot be passed over lightly. The reader is aware that the lateen sail, which had been originally the characteristic sail of the Mediterranean (and is to this day), had been during the Middle Ages used on board carracks. In the case of a three-master, for instance, it was always set on the mizzen, and sometimes the same kind of sail was on the mainmast and even the foremast. Amid the changes which in the flight of time were made in big ships the lateen sail still remained on the mizzen or aftermost mast until the period of the eighteenth century. Of more or less triangular shape, it consisted of one yard and the sail laced thereto, so that a part projected ahead of the mast to which it was attached. But now that projecting part is cut off so as to make the sail four-sided instead of three, and to resemble those early mainsails which we spoke of just now as existing on the early fore-and-aft ships of the sixteenth century. Finally a boom is added to the sail, with sheets, and from the peak vangs, or guy-ropes, which lead down to the stern. Thus we get practically the spanker or driver of the modern full-rigged ship.

The new method of describing and discriminating the various types of naval vessels was according to

ENGLISH AND DUTCH WARSHIPS OF THE TIME OF CHARLES II.

Some of them were over fifteen hundred tons, and the English ships were rivalled by the excellent vessels which the Dutch and French were then constructing. It was in Charles II.'s reign that the Dutch invaded the Medway and burned our ships.

their rating—a first-rate, for instance, denoting a ship of a hundred guns and upwards, which she carried on three decks. A second-rate also had three decks, and carried from ninety to a hundred guns; third-rates had but two decks and from sixty-four to eighty-four guns; fourth-rates had from fifty to sixty guns, whilst fifth-rates had from thirty to forty-four guns, and sixth-rates carried only twenty to thirty guns. Vast improvements had taken place in the design and construction of the ship. The towering forecastle and mammoth poops had disappeared before the end of the eighteenth century; copper sheathing had been introduced for the protection and acceleration of a ship's hull in its passage through the water; batteries were no longer placed so low to the water's edge (for the previous practice had been fraught with several appalling disasters when the ship had heeled over slightly so as to allow the sea to enter through the port-holes and sink her). The length along the keel was made greater in proportion to the beam; greater care also was taken with the seasoning of the wood for the ship's timbers and planking, so that about the year 1765, when Nelson's famous *Victory* was first sent down into the water, England was building the fine old wooden walls which will always be had in remembrance as representing the high-water mark of big wooden battleships propelled by sail-power alone. The lesson in perfect building had been a long time coming, and it had necessitated unlearning a good many faults, but though the design of such ships as the *Victory* is to our eyes unnecessarily clumsy and ponderous, yet it was according to knowledge; and the greatest advance in scientific design, in spite of all that had been learnt from the French of the eighteenth century in regard to this, was withheld as the privilege of the nineteenth and twentieth century naval architects.

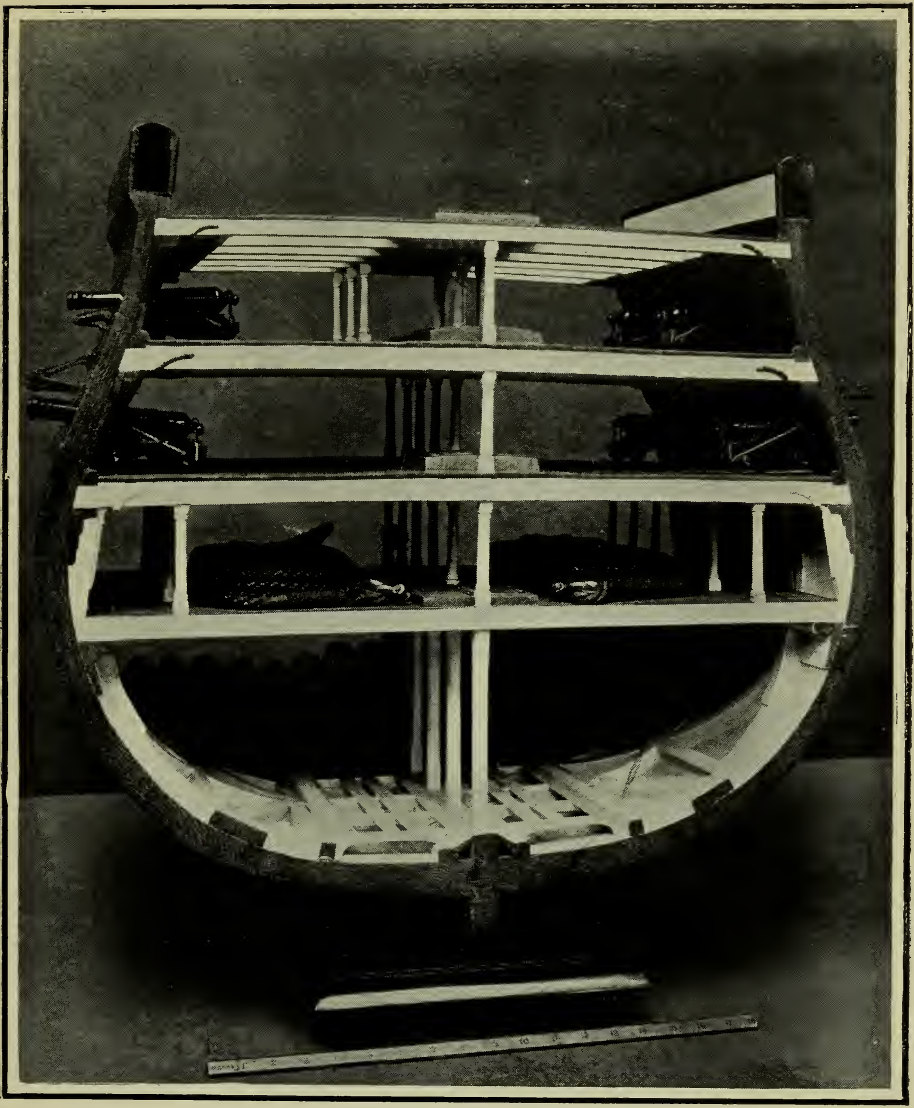
CHAPTER VII

THE FINAL DEVELOPMENT OF THE SAILING SHIP

WE have seen how the ship, after beginning in so elementary a fashion, had at last arrived at a stage very near to perfection, though lacking still something which time alone could add. Let us see what further development the last hundred years have brought.

Practically, the ships that fought at Trafalgar under Nelson were of the Stuart type with comparatively slight modifications, and it was not until some time after the beginning of the nineteenth century that the Stuart influence in shipping was really dead. In the meantime not Spain, nor the Low Countries, nor France was becoming likely to rival us in shipbuilding, but the United States of America, between whom and ourselves war broke out in 1812. The Americans had learned to produce a certain type of frigate that was superior to anything we had yet shown signs of being able to turn out, and for some time these big vessels undoubtedly influenced English shipbuilding. But before then the old-fashioned bluff bows were being replaced by a rounder entrance where the vessel breasts the waves. So, too, the shape of the stern was modified; for in place of the square, box-like transom-stern, the ship was given at this section a rounder design, and this rejection of the fashion which had obtained so long was completed by the action of Sir William Symonds, who was Surveyor to the royal navy from 1832 till 1847. Among other changes which were made about this time was the painting of the hulls in the royal navy. These until the beginning of the nineteenth century were coloured in such a manner that their sides were a bright yellow, the upper works of blue, with broad black strakes at the water-line. Internally the vessel was painted red, so as not to emphasise the blood in evidence during an engagement. Nelson made a break in this continuity of a mediæval custom by painting his hulls black, with a yellow strake along each tier of ports, and the lids of the port-holes black also; and even in this twentieth century, though white has been long since substituted for yellow, many of our big sailing ships engaged in ocean trade present a similar appearance.

Iron was introduced to a very small extent for minor supports, though it was not until 1829 that iron shipbuilding really began, and after that ten years at least were needed to show its value for a ship's hull. The old hempen cable was not abolished until the first half of the nineteenth century, when the modern chain was re-adopted: we cannot say *introduced*, since it was already employed during Cæsar's time, as we saw in an earlier chapter. Although the triangular headsails were now, and had been for years, thoroughly established instead of the old sprit-topsail, yet the sprit-sail yard remained, and the sprit-sail (set, as before,



H.M.S. "Rodney"

This shows the midship section and disposition of the guns of H.M.S. *Rodney* which was built in 1833, and is interesting as affording some idea of the last "wooden walls of England." Notice the amount of "tumble-home" which the top-sides of the hull possess.

below the bowsprit) was also retained for some time in the navy, and much longer in the mercantile marine. There are still living many sailors who remember being shipmates with it in the merchant service, where it was known under the nickname of "Jimmy Green." The bowsprit now becomes a three-part spar, consisting of bowsprit, jib-boom, and flying-boom, and to counteract the upward strain a small spar fixed at right angles to and below the bowsprit, and called a dolphin-striker, was added. Studding-sails were kept in use as they had been for centuries, but they seem to have disappeared when the clippers departed from the sea. These were additional sails set when running sufficiently free before a wind in moderate and steady breezes. They extended beyond the extremities of the principal square-sails, and additional booms were employed which slid out from the yards. A kind of studding-sail called a "ring-tail" was also set on, and abaft, the spanker or driver (which we saw evolve from the lateen mizzen). The two lower corners of the ring-tail were stretched out along an additional boom, which slid out from the proper boom of the spanker in the same manner as the studding-boom was projected along the yard. Nowadays, on many big ocean-going sailing ships the gaff or upper spar of the spanker is done away with, and a triangular trysail is set instead in the same place, a smaller gaff being still retained much higher up the mast for signalling purposes.

We mentioned at an earlier stage the foundation of the East India Company and the impetus which this gave to the building of fine big merchant vessels, and at the beginning of the nineteenth century the ships engaged on this line were some of the very finest sailing craft that the world ever saw or ever will see. The excellence of their building and of their sailing capacities was beyond praise. Presently the West Indies also attracted trade, and here was yet another influence which advanced and at the same time moulded the best of British shipping. The West Indiaman was inferior in size to the East Indiaman, but faster, and bore a strong likeness to the contemporary frigates of the royal navy.

And so we come to the stage when the sailing ship reached her zenith, and the sentiment which will always be attached to the ship was at its highest. We are about to speak of the famous historical clipper, now, alas! banished from the sea, and never likely to return unless all the mechanical forces now employed to propel the ship shall some day be found inoperative. She had her origin not in England but America, and it was not a rough rule-of-thumb method of building which made her what she was, but careful reasoning and science as applied to shipbuilding. The legacy left to shipbuilders by the Stuarts was that of a bold, full-bodied ship which made her way through the water by positive force. The same heritage was only slightly altered during the pre-clipper period. But it was reserved for the American naval architects to point out that if speed was to be an important characteristic of the ship she should rather slip through the water than push her way through the sea. The greater the friction the greater must be the loss of speed, they argued. So to this end another trace of seventeenth-century clumsiness was swept away. The bow was made so that it "clipped" or cleft the water instead of pounding into it, and the lines of the hull and stern generally were so altered as to diminish resistance. Other improvements, including the cut of the sails, were made. As a result the Yankee clippers of the 'forties and 'fifties obtained the blue ribbon for quick passages, to the great loss of British prestige and trade.

But in 1850 England began to build vessels of the clipper type, and the famous Blackwall Line came into existence. The *Challenger* was launched, and beat the American *Challenge* in a race from China, and other famous clippers were afterwards built which made remarkable passages for speed. In America, soon after the first half of the century, *The Great Republic*, a magnificent 3400-ton "shipentine" (as her countrymen described her), was built, and this was the first ship to be fitted with double topsails, so that by splitting up the area of the sail into two the canvas could be more easily dealt with in a breeze. This improvement still survives in the rig of our modern big sailing ships, and double topgallants, too, are found to be a considerable improvement on the old single-sail idea. One stage further and we see wood, which from the earliest times had been always employed for constructing ships of the sea, discarded, so that the hull is now for the first time made of iron, the chief benefit of which was a great saving in weight without losing anything in strength.

It is not fitting that we should dismiss the clipper ship from our record of the ship's romance without saying something of the wonderful feats of sailing which these vessels performed; for if the introduction of steam had not come so soon and the days of the big sailing ship had been prolonged, this wonderful class of vessels would have had a far longer time of encouragement and one more in accordance with their deserts. Between the years 1860 and 1870 we see the clippers at their best. In the latter year came the opening of the Suez Canal, which shortened the route to the Far East and gave an opportune opening to the steam-propelled craft; yet even then the trade to Australia and New Zealand was for some time carried on in these sailing ships.

There was an American clipper built in 1853, called the *Red Jacket*, which held the record for quick passages. Her run of 3184 miles in ten consecutive days, during one of which she logged 400 miles, will not easily be forgotten as long as sailing ships are remembered, though even this was afterwards improved to 417 knots. It was the American Civil War, lasting from 1861 to 1865, that turned the attention of our Western cousins from shipbuilding to internal troubles, just as a similar cause had put back our own advance during the Wars of the Roses. From the time when American success on the sea got its set-back until this day, Great Britain has gone ahead in its shipbuilding, though at present her rival would seem to be springing up in Germany, whose advance during the last few years has been exceptional.

The British clipper ship *Thermopylæ*, of 1991 tons, started off in 1868 from Gravesend and went her way round the world, breaking the record on each passage. Leaving the London river on November 7, she had passed the Lizard by six the next evening and was out of the English Channel the same night, arriving on January 9 off Port Philip, Melbourne, having taken sixty days from pilot to pilot. From Melbourne she went to Newcastle, New South Wales, where she took in cargo and proceeded to Shanghai, arriving there after a passage of twenty-eight days, which created another record. From Shanghai she sailed back to London in ninety-one days, which made still another record; but even this was beaten a fortnight later by the *Sir Lancelot*, another famous clipper, which did the journey in eighty-nine days. The latter also in 1872, on a voyage from Shanghai, came home in 122 days, although she carried away her rudder on the way. The *Thermopylæ*, after the opening of the Suez Canal, when at last she was outrun by steamers, became a general trader until 1895, and even then did a fine passage. Thereafter she was sold, and is now a training-ship on the Tagus. Many of the other fine clippers were bought by foreign owners, especially those engaged in the Norwegian timber trade. The *Sir Lancelot* was lost in 1896 in the Bay of Bengal during a cyclone. Another memorable passage was that which the *Ariel* and *Taeping*, two tea-clippers, performed in 1866. Together with the *Serica* they left Foo-Choo on May 30, and never saw each other again until they found themselves in the English Channel. *Taeping* and *Ariel* passed the Lizard together on September 6, the former arriving in the London Dock the same day at 9.45 P.M., the *Ariel* reaching the East India Dock at 10.15 P.M., *Serica* coming in but a few hours later. When races extending over three months could be ended with only a matter of half-an-hour separating the rival ships, it is obvious that there was nothing much lacking in either the seamanship or the navigation of the skippers who had the privilege of commanding such fine ships. We could go on multiplying instances of the record voyages of these clippers, but our space is limited and we must be content to pass on in our story.

The big sailing ship happily still lingers, but how much longer she will remain who shall say? For picturesque beauty, what is there among the works of man's hands so deserving of our respect and admiration as the full-rigged ships which go out to fight for their very existence against seas and gales, manned by ill-paid, frequently ill-fed crews, arriving back in harbour with sails and spars carried away, wheel smashed to pieces, men lost overboard, yet able to deliver up the cargo which they have toiled so hard to fetch? Who that has ever watched these beautiful objects coming into Falmouth and dropping anchor, to wait for orders after a long and strenuous voyage perhaps all the way from San Francisco, round Cape Horn and up the Atlantic, has not felt some emotion as the "rattle-rattle-rat" of the cable into the waters of an English harbour comes as the sweetest of musical sounds to hard-worn men so long exiled from their mother-home?

Built to-day with a greater regard for carrying capacity than for speed, the big sailing ship has none the less made and broken records which will stand comparison with some of the clipper performances, and many of the four-masted barques are anything but slow, and would give a steam tramp some trouble to keep up with them. The *Loch Torridon*, for instance, made a passage from Newcastle (New South Wales) to San Francisco in forty-six days, and in 1891 she beat no less than seventy-eight other vessels, coming home from Sydney in eighty days. The following year she went out to Melbourne in ballast in sixty-nine days, her best day's run being 341 knots.

Looking at a modern full-rigged ship nowadays, how many changes do we find have come over her! Her hull is no longer of wood, her rigging is of wire and iron; rigging-screws have taken the place of rope-lanyards, spars and masts are of steel, chain has taken the place of hemp. At one time the clippers, in their greed for pace, set not merely topsails and topgallants and royals, but sails even higher still, known as "sky-scrapers" and "moon-rakers." They had valuable, perishable cargoes of tea on board, and every hour was important to them. But nowadays it is rare to find a ship setting any sail above the royals, and of course studding-sails have disappeared also. Bowsprits on these modern big ships are made of steel or iron, while the employment of staysails has increased, these occupying the vacant space as fore-and-aft sails between mast and mast.

But besides the vessels which make voyages across oceans, there is still a large amount of trading carried on in sailing coasters. For this coasting work, and for shorter voyages, that rig which is peculiarly suited for the deep sea is less fitted. Something handier is demanded when narrow channels and ports have to be entered with greater frequence than the full-rigged ship or barque is ever called upon to do. In the eighteenth century the favourite vessel for this kind of work was the brig, which was especially engaged in the coal-carrying trade, now replaced for the same office by the steam-collier. Most of the other coast trade, when carried by sailing ships, is done in topsail schooners; but the Thames barges, of which we spoke on an earlier page, have gradually developed in one direction to such large dimensions that one frequently encounters them in the English Channel and up the North Sea, a long way from the mouth of the Thames.

But of the numbers of sailing craft still employed a considerable number are found in the fishing fleets of Scotland, England, and Ireland. The North Sea fishing vessels are usually rigged as ketches, as those who have seen them putting to sea from such places as Great Yarmouth, Lowestoft and Ramsgate are well aware. Brixham, too, can boast of some of the finest of this type, but the cutter-rigged "mumble-bee" is also a favourite for the west country fishing. In Scotland and for the Cornish coast the lugger is the favourite. For yachts the cutter is the most popular kind of craft for moderate-sized vessels. When the sail area demands that it should be split up, the rig becomes either a yawl or ketch, but in the case of larger vessels still a schooner rig is found advisable.

Thus far, then, we have followed the romance of the ship as a vessel propelled for the most part by means of sails, but sometimes by oars also. To some minds it would seem as if it is here that the romantic aspects of the ship conclude; but though few would deny that the "great-ships" of mediæval times and the clipper ships of the nineteenth century, with the grand old "wooden walls" in between, compose the crown around which there remains for ever a halo of something approaching reverence, yet it is absurd to suppose that in the developments which have taken place since the introduction of steam the ship has lost her magnetic personality. Sentiment is one thing and utility for the general welfare of the human race is something quite different, but has as just claims to be listened to as the other. There is no such thing in the world as standing still; either there is advance or retreat. When the early shipbuilder found he could make a better craft by building, rather than hollowing out, he did not hesitate to avail himself of a new invention. When our ancestors in the Stuart times found that the Dutch pointed out a better manner of designing and constructing a ship, the Englishmen of that period were not slow to follow along the new way. And so, when it was found in the interests of the ship, and not merely of the ship but of progress too, that steam should be applied as her means of propulsion, the shipmen of the last century, with perfect wisdom and even greater enterprise and courage, did not throw away the opportunity thus offered to increase the sphere of a vessel's usefulness. The story of the sailing ship is that of air employed in sending her through the water; the story of the steamship is that of vapour applied to propel the vessel without dependence on the motion of air. In the one case it is the current of air which does the work; in the other instance it is a current of vapour. There is no reason why on that account this succeeding part of our story should seem bereft of any romance. It is because we are living too near to the beginnings of its history that we are apt to treat it in a manner too suggestive of contempt. It is the old story of distance lending enchantment; for, romantic as the Spanish galleon appears to our minds to-day, yet it is only lapse of time that effects this. To the poor, tempest-tossed individuals who had to endure her leakiness, her unutterable stench, her abominable pitching and rolling, her crankiness and unwieldiness, the galleon was anything but romantic. A couple of centuries onwards, and the story of steam in relation to ships will be regarded by our descendants as no less worthy to be read than that of the sail.

The difficulties which the creators of steamships had to contend with were far greater than those which threatened any shipmen since the practice of shipbuilding first began, for the reason that something totally new was being introduced, something of which even the introducer himself knew but little, and that but experimentally. The Phœnician and Greek and Roman knew certain facts about the sailing ship, because the Egyptians had handed their knowledge down. From 6000 B.C. and earlier down to the nineteenth century, the shipbuilder's and the ship-designer's tasks were simply improving on the work of his predecessor. With the advent of steam something entirely fresh was brought about, which might have been a success or a failure; no one knew. It will be our task in the following pages to show how successful have been the results of this innovation in so short a space of time, and how it has revolutionised both the navy and the mercantile marine to an extent unthought of and at one time denied.

CHAPTER VIII

THE ADVENT OF STEAM

NO one would be so foolish and inaccurate as to deny that there is still life in the sailing ship. It will not be for many years—if ever—that she will disappear from off the surface of the sea; but nevertheless it is only for special purposes that she is retained, and even for these the motor is gradually being more and more employed, not so much as a rival of the sail but rather as its auxiliary. In the special instances of fishing craft and yachts this is specially noticeable.

The opening of the Suez Canal in 1870 was certainly one of the greatest blows to the sailing ship which she ever encountered in the whole of her romantic history; for although steam had been in use for marine purposes long before this date, yet had this been confined for the most part to vessels engaged in cross-channel, coasting voyages, or on the North Atlantic route to the United States. But the coal consumption of the first steam vessels was so extravagant, in comparison with the amount of horse-power developed, that for some time longer there was considerable value still in the big fast sailing ships; and for a period extending beyond the year when the Suez Canal was opened and the route to the Far East shortened, the traffic to New Zealand and Australia was carried in those fine "fliers" which we saw in the last chapter. But in spite of the wonderful voyages which these sailing vessels made—in spite, too, of the exceedingly plucky manner in which they fought for their very existence until the last—their end was inevitable for general commercial purposes in the safe conveyance of passengers and merchandise across the seas. The increasing trade done in perishable foods, the gradual quickening of life, and the increased value of time soon made it impossible to tolerate the ship that had to be at the complete mercy of wind and weather.

But let us see how the steamship began to wage the fatal war which ended in the conquest of her older sister. We have no space here to trace the fascinating history of the discovery of steam as a generator of force; we are concerned entirely with the manner in which it has been applied to the service of the ship. Like many other inventions, the steamship was not the result of a sudden flash of intellectual brilliancy, but the last stage in a particular kind of development—or rather one of the stages, for the steamship, in spite of all its wonders and magnificence when expressed in *Mauretanias* or *Dreadnoughts*, is still developing; nor is it likely to attain finality as long as it is found useful. For a long time different minds had set to work to devise some mechanical means of propelling a ship in a calm, not by means of steam but with manual power and capstans, paddle-wheels in some form being the method of conveying the power and placing it in contact with the water. As early as 1736 a steam vessel was patented by Jonathan Hulls, to be used as steam-tug, and this ship is even said to have been built and experimented with in the following year; but evidently it was found wanting, for the attempt was subsequently abandoned. In this ship the paddle was placed singly—at the stern, and not at either side. In 1783 a two-paddle-wheeled steam craft, turned by a single horizontal steam cylinder, was propelled for some time against the current of the Saône. This was constructed by the Marquis de Jouffroy. Four years later William Symington obtained a patent for a new steam-engine, but for some time a Patrick Miller had been experimenting on the old idea of propelling craft by hand-worked paddle-wheels, and Symington was asked to design an engine so that the ship might not need the tremendous manual labour, but go ahead under steam-power. In the autumn of 1788 the engine was put on a double-hulled craft only 25 feet long and 7 feet beam, or about the size of a four-ton yacht, the engine being geared with chains and the two paddle-wheels being placed not on either side but between the two hulls, and one wheel being astern of the other. The vessel was tried on Dalswinton Loch, when she was able to show a speed of five miles an hour.

In 1801 a stern-wheeler called the *Charlotte Dundas* was built at Grangemouth, and was supplied with engines also by Symington, who had installed those in Miller's ship. She also had a double stern with two rudders, controlled by a steering-wheel placed in the forward end of the vessel. She proved her ability by towing two loaded vessels, each of 70 tons burthen, for a distance of 19½ miles on the Forth and Clyde Canal; but the pro-

MILLER'S DOUBLE-HULLED SHIP

This illustration shows an attempt to give the appearance, from existing information, of one of Patrick Miller's vessels. He experimented with about eight, but the ship here depicted was built in 1787, and consisted of two hulls connected together. The paddlewheels were turned by thirty men, when a speed of over four knots was obtained. When sails alone were resorted to, the paddlewheels could be raised out of the water.

prietors of the waterway feared for the damage done to the banks of the canal and condemned the vessel.

So far, then, the steamboat had received little but discouragement. The subject was engaging the attention of more than one eminent engineer simultaneously, but it was not until 1807 that the real beginning of the steamship takes place, when the *Clermont*, a much bigger ship than the *Charlotte Dundas*, was launched. Her length was 133 feet and her beam 18 feet. The *Clermont* owed her existence to Robert Fulton, who had had the opportunity of seeing the *Charlotte Dundas* on her trial trip in Scotland, and had been able thus to gain a number of ideas which were to come to fruition. He arranged with Messrs. Boulton & Watt to make for him the principal portions of a suitable engine, and these were sent across to the United States and fitted into the *Clermont*, which ran passages up and down the Hudson from New York to Albany and back. This ship may be said to have settled finally the question as to whether the steamship would or would not have a career of commercial utility; for its success, though to us it now appears but elementary, was pronounced, and from that, or rather from the *Charlotte Dundas*, may be traced the genealogy of the modern mammoth liner with her powerful turbines and express speed, at once awe-inspiring and magnificent. Even though the greatest success had so far taken place not in Great Britain, but in the United States, yet much of the inspiration had come from the former.

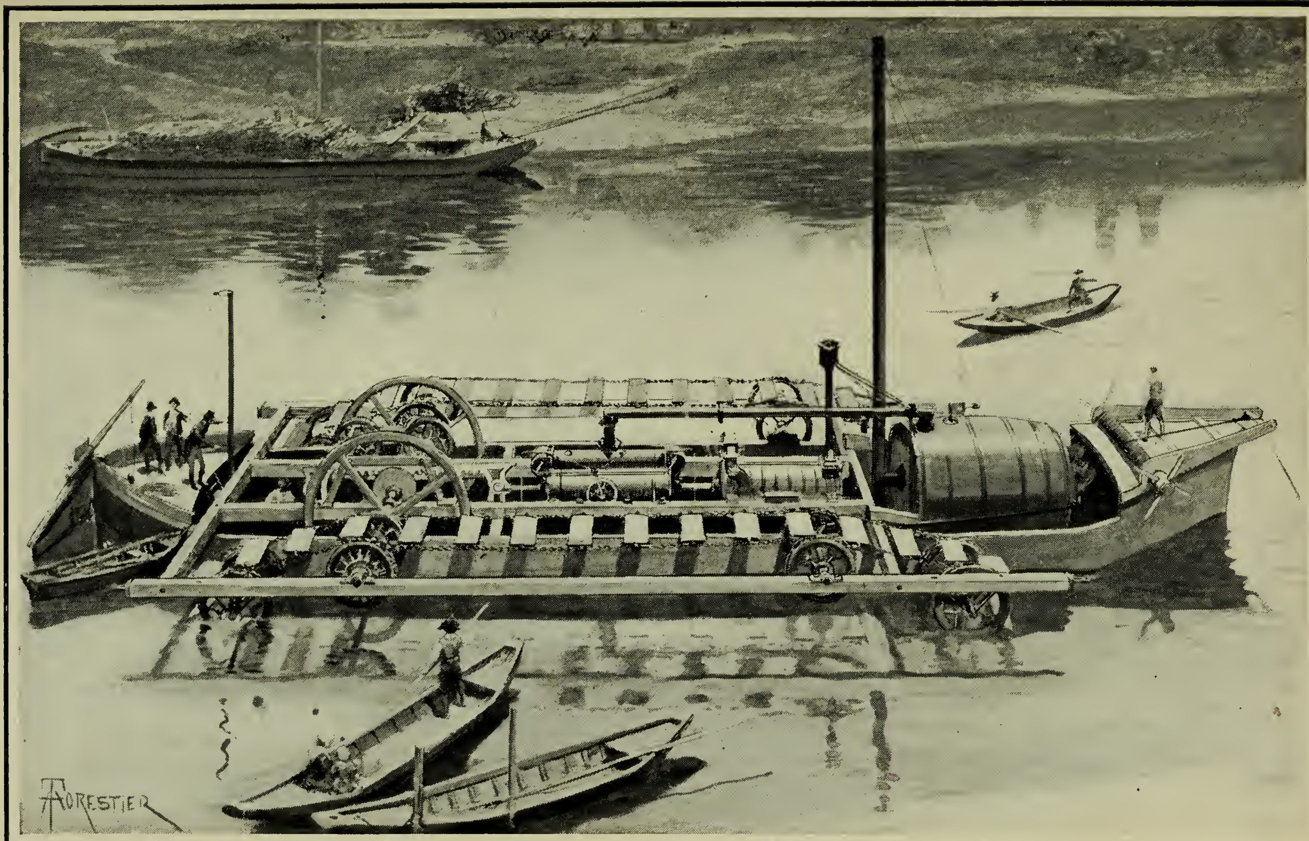
But now we find that, four years after the *Clermont* had inaugurated a passenger service abroad, Great

Britain was to see the launching of a steamship which, beside the *Clermont*, will go down to succeeding generations as in the highest degree memorable. For in the year 1811 there was launched on the Clyde a curious-looking little craft, 40 feet long on the keel, having a bow still reminiscent of the later Stuart times, clumsy of design, and with a speed of five miles an hour. She was fitted with a yard and square-sail like the foresail of a full-rigged ship of that time, with braces coming down on deck from either yard-arm. This was hoisted not up a mast—for she lacked such a spar—but on the long narrow funnel which, being well forward in the ship, took the place of a mast. She also had a short bowsprit on which was set a small triangular jib. Originally this vessel, which was called the *Comet*, was provided with four paddle-wheels, but two of these were found to be adequate and conducive to greater speed. The practical success of the *Comet* convinced shipbuilders and engineers that henceforth their work was that of collaboration, and that between steam and ships there was to be the closest relation. During the next few years paddle-steamers began to be introduced on the Clyde and also the Thames and Mersey. By 1817 a steamer called the *Caledonia* had not merely been taken from the Clyde to the Thames, but, after receiving new engines, proceeded under her own steam subsequently to Rotterdam. Hitherto all the steamships had been little more than river-craft, whose occasional coasting voyages had been attended with considerable danger and many adventures. With a tall, thin, single funnel and a figurehead at the bows, according to the prevailing custom of big sailing ships, there was little if anything to admire in beauty of form. Their entire virtues were summed up in the engines, and by seamen who had never known any other kind of craft than those propelled with sails or oars the new order of things was treated with the greatest ridicule and scorn.

But in the year 1818 the *Rob Roy*, a 90-ton vessel with a nominal horse-power of 30, was constructed by William Denny and engined by Napier, and after running for some time between Greenock and Belfast she was engaged in the Dover to Calais route. Here, then, was an improvement on the mere river-boat, for as her regular work she made voyages, though of limited scope, across the sea. In the meanwhile the steamboat was beginning to be appreciated in other parts of Europe. In 1815 the *Elizabeth* was running on the Neva, having been rebuilt and engined at St. Petersburg; another steamer was engaged in passenger traffic between Cronstadt and St. Petersburg; whilst the first steamer built in Germany, named the *Prinzessin Charlotte*, a double-hulled vessel with a single paddle-wheel between the hulls, was employed on the Elbe and Spree as early as 1816.

Three years later and the now famous *Savannah* had shown that a vessel fitted with steam-power was not necessarily unseaworthy; for not merely could such craft endure coasting and cross-channel trips, but they could also be trusted to cross the North Atlantic in safety. It was in the year 1819, then, that the *Savannah*, a full-rigged ship of 350 tons built in America, fitted with a low-pressure engine giving only 90 horse-power, with a couple of paddle-wheels which could easily be detached and taken on board, started off from New York, bound east, after calling at a couple of American ports first. Her voyage lasted just under thirty days, and she arrived safely in Liverpool. But though the *Savannah's* trip is interesting, it proves practically nothing as to the steaming abilities of a vessel that was able to cross the North Atlantic, for she relied for the most part on her sails, whilst her engines were merely auxiliary. On the whole voyage across she used steam only for eighty hours, and by the time she had arrived off the Irish coast all her fuel had been already consumed. It was well, therefore, that she was thus plentifully supplied with sail-power.

It is as a sailing rather than as a steam vessel that we must for ever regard the *Savannah*, and on her return to America her engines were taken out of her and she became a sailing ship again. England, too, showed she could build a bigger sea-going steamship when, two years after the visit of the *Savannah*, the celebrated *James Watt* was launched at Glasgow. With a tonnage of 420 and two engines and paddle-wheels, she was rigged not like the *Savannah* but as a three-masted fore-and-aft schooner with jib, staysail, and jib-topsail. Her square stern, her band of white and black ports, her bow with figurehead, are all in keeping with the naval architecture of the time. With a high smoke-jack placed between the foremast and the main, with her paddles now covered up on the top by boxes—unlike the *Savannah*, whose paddle-wheels had been left open—the *James Watt* represents a type of sea-going steamer which remained for many years, with but minor adaptations externally, as the prevailing ex-



DESBLANC'S EXPERIMENTAL STEAMBOAT

This illustration represents an attempt to reconstruct the curious craft that Desblanc had made about the time Fulton was experimenting with the steamship problem in Paris. Desblanc was a man of great ingenuity and originality, but Fulton severely criticised his haphazard methods, and the Frenchman never achieved any practical result with his steamcraft.

pression of the combined wisdom of the shipbuilder and the marine engineer.

In spite of the chilly reception with which steam had been received by most people in any way connected with ships and the sea, there were the most sure and certain signs that the revolutionary innovation had come to stay. By 1825 a little auxiliary steamship of only 176 tons, named the *Falcon*, had reached Calcutta, going round Cape Horn, and in the same year the *Enterprise*, a bigger ship of 470 tons, had made the same voyage, and during 103 out of 113 days of her journey was propelled not by sails but under steam-power. This proved still more the capability of the steamship, though it was to be many years before sails ceased to be relied on, at least for emergency if not for ordinary propulsion. Although the success of the *Comet* had been so recent and opposition had been so obstinate, yet two years after the voyage of the *Enterprise* just alluded to there were no fewer than eighty steamers classed in Lloyd's Register, while five years later still this number was increased to a hundred.

Notwithstanding all this, steam was still scoffed at, and the incredulous who had been brought up among sailing ships were not yet convinced of the superiority of steam for long voyages. There were many, indeed, who firmly denied that the Atlantic would ever be crossed in a ship propelled under steam alone, but in the ever-memorable year of 1838 the representatives of the old school were to have a rude shock, for the matter was settled decisively, and the superiority of steamships was asserted beyond all question of doubt for maintaining communication between America and this country. Hitherto sailing vessels, with more or less regularity, had wallowed their way across. Remarkably able vessels some of them were, but the gales of the North Atlantic are more than enough to make the punctual arrival of a sailing ship utterly impossible. During this year, then, not one but four vessels crossed to New York and Boston under steam-power all the while. Hitherto no vessel had achieved such a distinction, when shipbuilders, naval architects, and marine engineers set to work to produce such a craft as would bring this about. The ship thus specially created for this service was the celebrated *Great Western*, about which we shall say more presently. The other vessels were the *Sirius*, the *Royal William*, and the *Liverpool*. Their respective achievements may be summed up as follows.

The *Sirius* sailed from London on April 4, 1838, and arrived in New York on April 22. The day after arrived the *Great Western*, which had left Bristol on April 7. The *Royal William* was, however, the first steamer to cross from Liverpool to New York, the pioneer of that endless stream of liners which has gone on week after week up till to-day with marvellous precision, considering the nature of the passage and the distance to be covered in all kinds of weather. She had been built two years before for the Irish trade between Liverpool and Kingston, and it was in July, a few months after the *Sirius* and *Great Western* had performed their feat, that the *Royal William* was despatched on a journey for which she had not been originally intended. She accomplished her novel task, however, in safety, and took about as long on the journey as the *Sirius*. From the satisfactory performances of these vessels, especially the *Sirius* and *Great Western*, two very important results followed. Firstly, the British Government were now so impressed with the successful voyages of these steamships that they invited tenders for the carrying of the American mails in steamships instead of the old brigs which had hitherto done the work. That was the first result, but the second which arose from this was the founding of the celebrated Cunard Line by Samuel Cunard, a prominent Nova Scotian merchant. Under the title of "The British and North American Royal Mail Steam Packet Company," they were granted the Government contract for carrying the mails across to Halifax and Boston from Liverpool. This was to be done in four suitable steamships, and fixed dates of sailing were to be adhered to, in consideration of which the Government was to allow the Company an annual subsidy of £81,000. These four ships were all wooden paddle-wheelers built on the Clyde in 1840, and supplied with engines by Robert Napier, the *Britannia*, which was the pioneer of the fleet, being of 1154 tons, with an average speed of 8½ knots. After leaving Liverpool on July 4, 1840, this ship arrived safely at Boston, her passage having lasted 14 days 8 hours.

But before we proceed further, let us go back for a moment to have a look at the *Sirius* and *Great Western*. The former, rigged as a brig-schooner (that is, with square-sails and yards on her foremast, but only a fore-and-aft mainsail with gaff-topsail on the main, this rig having but two masts), was a 700-ton paddle craft, and had previously been employed in the Irish trade. By now the smoke-stack has advanced a step nearer to what it appears to-day, being wider and shorter than was seen in the days of the *Clermont* and *Comet*. Her paddle-wheels are covered in at the upper semicircle as to-day, but the bow has not yet reached the beauty and fineness of design which characterised the clippers presently. Round her stern, still exceedingly old-fashioned, ran a row of ports, reminiscent rather of the gun-brigs than suggestive of the first of that long line of steamships which have since crossed the Atlantic.

The *Great Western*, like the other vessels, was of wood, and it is amusing to recall what was her right to be called "Great" when we mention that her tonnage was only 1321 gross. (The gross tonnage of the *Lusitania* is 33,000.) Built at Bristol as really an extension of the Great Western Railway system across the Atlantic, her quickest passage was afterwards done in 12 days 7½ hours bound eastward, and 12 days 18 hours bound west. The largest number of passengers she had carried in one voyage was 152. She was constructed with enormous strength, and after doing excellent service was broken up in 1857. This ship will always be associated with the fact that it was chiefly through her success that the rise not merely of the Cunard but of the other great steamship lines followed. The foundation of such well-known lines as the Peninsular and Oriental Steam Navigation Company, the Royal Mail Steam Packet Company, and others about this time were events of national importance rather than of mere commercial enterprise; for not only has the mercantile marine led the way in the development of steamships of any sort, but without this practical exhibition of faith in the newer kind of ship on the part of private firms the coming of our steam battleships had been much longer delayed.

To-day the enterprise of the royal navy in regard to the development of the steamship is so remarkable that it is difficult to realise the very opposite conditions which prevailed during the early years of the nineteenth century. Those who happened to have been at Cowes in August of 1908 will remember the arrival of H.M.S. *Indomitable*, which had arrived from her voyage across the Atlantic with such speed as even to eclipse the fastest ocean greyhound. To have obtained this distinction in a vessel built primarily as a fighting unit, and not as a speed-maker, was an achievement of which the Admiralty of to-day might well be proud. And yet this same body in the beginning of Victoria's reign, when it was suggested to them that it would be to the advantage of the country that steam should be introduced into the navy, were affrighted and nonplussed at the preposterous proposal. The minute of the Board of Admiralty of that time condemning this innovation is worth quoting, for it shows in the most amusing manner how pig-headed officialdom is capable of showing itself.

CHAPTER IX

THE FIRST STEAM WARSHIPS

"THEY felt it," runs the wording of the Board of Admiralty in Lord Melville's time, "their bounden duty, upon national and professional grounds, to discourage to the utmost of their ability the employment of steam vessels, as they considered the introduction of steam was calculated to strike a fatal blow to the naval supremacy of the Empire; and to concede to the request preferred would be simply to let in the thin end of the wedge, and would unquestionably lead to similar demands being made upon the Admiralty from other departments." The reader may well gasp at the suggestion that the introduction of steam would strike a fatal blow at our naval supremacy. But in spite of this expression steam was at last introduced, though not till it had been for some years satisfactorily employed in commercial craft.

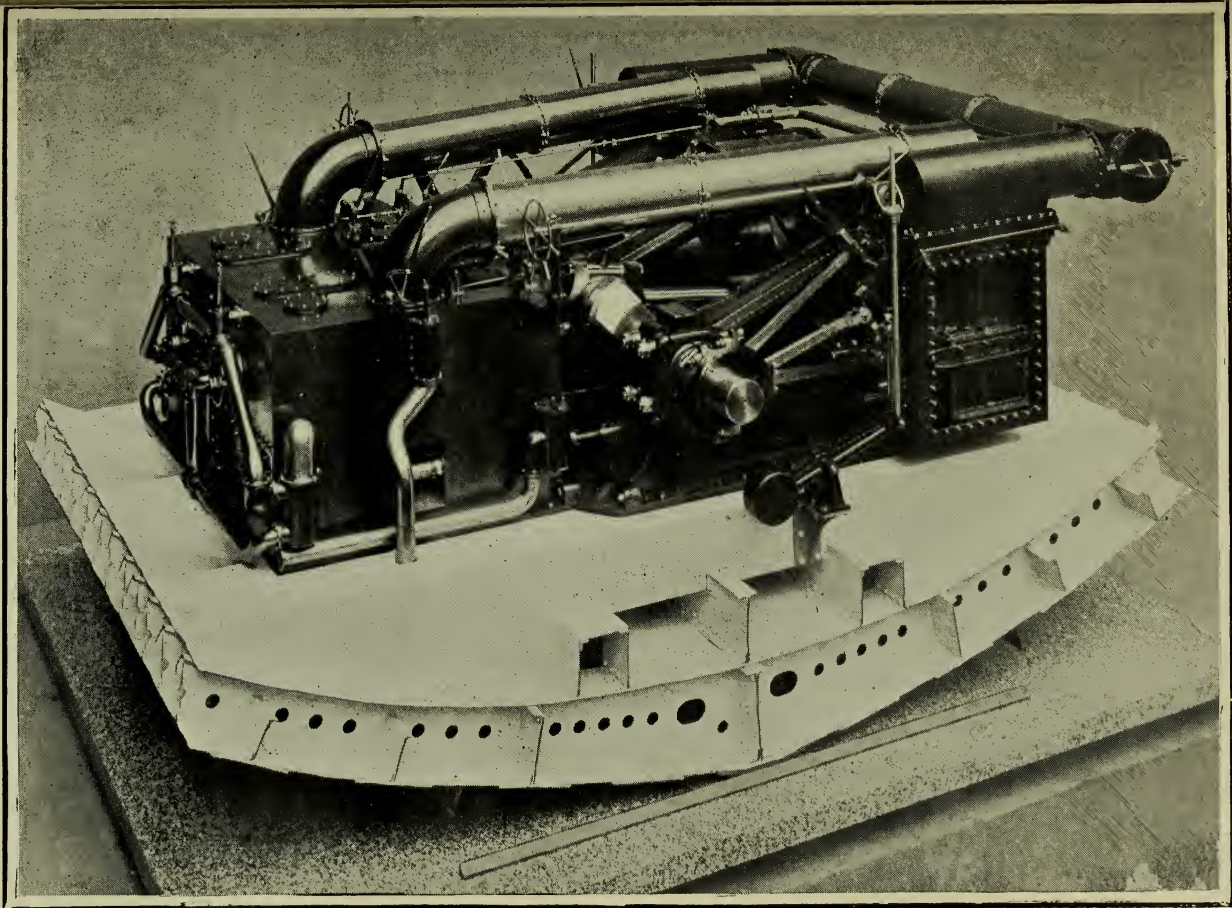
Only as late as the year 1821 the *Monkey*, which had been laid down at Rotherhithe in 1820, was bought by the Admiralty for use as a steam-propelled craft. She was a paddle wooden steamer of 212 tons, and fitted with engines of 80 nominal horse-power, and had not been originally intended for the service. The *Comet* (not, of course, the vessel of that name we referred to in our last chapter), another paddle wooden steamer of 238 tons, was built at Deptford in 1822, having a nominal horse-power of 90. Other vessels of this type were the *Active* and the *Lightning*. But it must not be imagined that these were in any sense of the word men-of-war; their use was merely that of towing and special service.

Between 1823 and 1840 seventy steam vessels were added to the royal navy, most of them being fitted with flue-boilers and slow-moving side-lever engines, worked with steam pressure of only 4 lb. per square inch. In 1832 a number of other wooden paddle-steamers were designed for the navy, of which the *Alecto*, concerning which we shall have something to say presently, was one.

As the Admiralty had opposed the introduction of steam, so it acted with regard to iron. We shall deal with the part which iron played in the history of mercantile shipbuilding in a following chapter, but it is convenient here, in order not to break the continuity of the story of steam in the navy, to show the development of the naval steamship even when wood for the hulls of warships was beginning to be discarded. Leaving, then, for the present the origin of iron shipbuilding, let us turn now to the first iron warship, which was launched in June 1839. This was the *Nimrod*, which was built by Messrs. Laird of Birkenhead for that same old corporation which we saw sending its fine ships to the East as far back as the beginning of the sixteenth century, and which had maintained its high standard of vessels throughout the period when the sailing ship was at her prime. The *Nimrod* was built to the order of the East India Company, and was an armed paddle-steamer, 103 feet long, but the same Birkenhead firm also built an iron frigate for the Mexican Government.

In the same year as the *Nimrod* took the sea was launched the *Nemesis*, also for the East India Company, which drew as little as 5 feet of water yet arrived safely in India. It was not until the year 1840 that the Admiralty owned an iron steamship when the *Dover* was launched at Birkenhead. This was a paddle craft. Two years after this an iron steamer was built at Blackwall for a private individual, and was afterwards purchased by the Admiralty as the first screw-propelled vessel in our navy. Constructed of iron, she showed on her trial trip in 1843 that her speed was over 12 miles an hour, and on being taken over she became known as H.M.S. *Dwarf*, though she had been launched as the *Mermaid*. She was of 164 tons, and her mean draught on her trial trip was only 5½ feet, which is in wonderful contrast to the modern *Dreadnought*, which draws as much as 26 feet. In 1846 the unfortunate *Birkenhead* was launched as a steam frigate for the royal navy. Built of iron, she was eventually used as a transport, and had a tonnage of 1400. This vessel was also a paddle-wheel craft, and foundered off Simon's Bay, South Africa, six years after her launching, and 454 people perished.

The year before this historic disaster occurred two paddle-wheel gunboats had been built and engined by



Model of the Engines of H.M.S. "Northumberland"

The *Northumberland* was completed in 1868, as an armoured, first-class cruiser, being built of iron. She was the first vessel in the British Navy to be fitted with steam stearing gear. The illustration shows clearly the arrangement of the double-bottom. She developed a speed of over 14 knots, and her displacement worked out at 10,780 tons.

a British firm for the Prussian Government, but during the Crimean War they were obtained by the English Government in exchange for a 36-gun frigate, and saw active service under the names *Recruit* and *Weser*. Some details as to these two ships of war will afford the reader an idea as to how far steam vessels had advanced about the time when the clippers were beginning to win fame and fortune. Both these paddle-wheelers were double-ended, and could carry enough coal for steaming 2000 miles, whilst drawing when thus loaded only 7 feet of water. They were fitted with oscillating engines, making 33 revolutions a minute, which gave them a speed of over 11 knots per hour. Steam was supplied from four tubular boilers, and the paddle-wheels were 17 feet in diameter. Fitted with two masts and a sail area of 415 square yards, their gross registered tonnage was 334 tons each, length on the load water-line 178 feet, and extreme beam 26 feet.

As early as 1834 Francis Pettitt Smith (afterwards knighted), a Hendon farmer, had made a model propelled by means of a screw revolving below water. Subsequently he patented the invention and collaborated with John Ericsson, a celebrated Swedish engineer, who had also been working on this idea of propulsion. Smith had a launch built at Wapping in 1836, called, after himself, the *Francis Smith*, in order to put his patent to a more vigorous test than had been possible with his model; for the latter had been driven by clockwork, and although it moved successfully on the farm pond at Hendon, it was not till the *Francis Smith* steam-launch was built that the value of the idea could successfully be demonstrated.

However, this bigger craft, although she was only of six tons, was found to bear out all the promise which the small model had foretold. The propeller, which was of course driven by steam, was made of wood, and during the trials an interesting accident showed, what has since been frequently found out in much bigger craft, that the speed of a ship is not always in relation to the number of blades. A half of the propeller of the *Francis Smith* having by chance broken off, it was noticed that the little ship considerably increased her rate of progress and leapt forward with a speed that she had not hitherto possessed. Subsequently a metal screw was substituted, and the vessel ran trips between London and Folkestone, showing that she was capable of steaming 5½ knots per hour.

The first experiment with Ericsson's propeller was in 1837, and a ship named the *Francis B. Ogden* was built and thus fitted with the screw. She showed her ability by towing a ship of 630 tons at a speed of 4½ knots against the tide. The second experiment with this propeller was in the following year, when the *Robert F. Stockton* attained a speed of 13 knots on the Thames, but with a fair tide. Her tonnage was 33, and she subsequently crossed the Atlantic under sail-power.

In order to convince the Admiralty of the wonderful superiority of the propeller, it was arranged to tow the Admiralty barge, with their lordships on board, from Somerset House as far as Blackwall and back. This was done in perfect safety, and with such success that the speed maintained averaged 10 knots, yet in spite of this practical demonstration the Admiralty declined to be persuaded. The obvious advantage of the propeller in time of war, in that it was submerged and therefore far less likely to be hit than the paddle-wheels, was scorned; so once again the British navy was retarded in its progress. But so successful had been the results of the *Francis Smith* that a syndicate was formed and purchased Smith's patents, and the famous *Archimedes* steamship was built and launched in 1838, her tonnage being 240 and her length 125 feet. Fitted with a propeller, she proved her capability of keeping up a speed of 8 knots per hour against wind and tide, and subsequently, after she had steamed round the British Isles and made voyages to Oporto and elsewhere, the Admiralty were finally convinced, and a sloop named the *Ardent*, which was being built at Sheerness, was lengthened, fitted with a screw-propeller, and launched in April of 1843. Her name was changed and she became the well-known *Rattler*, of 888 tons, with engines having a nominal horse-power of 200, and a draught of 13½ feet. One of the most interesting sights of the nineteenth century was witnessed when, on a calm day in April of 1845, her Majesty's paddle sloop *Alecto* and her Majesty's screw sloop *Rattler* were made fast to each other at the stern and both started to steam ahead at full speed. It was not for long that the fate of the propeller hung in the balance; for the *Rattler*, although in size of ship and in nominal horse-power very similar to the *Alecto*, showed her superiority over the paddle-wheeler by towing her stern foremost at a speed of considerably over two knots. As a distinguished British admiral who witnessed the sight recently remarked, "*Alecto's* paddles were revolving and churning the foam like a whale in a flurry, while a slight ripple under the *Rattler's* stern alone showed that there was power at work. . . . *Alecto*, in spite of frantic struggles, was dragged slowly astern, and the era of the screw had begun."

Although the first naval vessel to be fitted with a screw was the *Rattler*, yet it was the *Agamemnon*, launched in 1852, that was the first line-of-battle ship designed from the first for the screw. It is interesting to mention that four years after the memorable contest took place in the North Sea between the *Alecto* and *Rattler*, another tug-of-war was seen, this time in the English Channel, between the screw corvette *Niger* and the paddle sloop *Basilisk*. This continued for an hour, and at the end the screw propeller had again showed her pre-eminence, for the *Niger* had towed the *Basilisk* astern nearly two knots. There was much that had still to be learned with regard to the shape and blades of the propellers, but that would come with time and experience. It was enough that by now the superiority not merely of steam but of the screw over the paddle had been shown to the conviction of the most obstinate and least credulous of authorities.

As improvements on the two gunboats already referred to as the *Recruit* and *Weser*, the Admiralty in 1856 had the *Bann* and *Brune* built. Of a smaller size and capable of carrying sufficient coal only for 800 miles, they drew only 4 feet of water and were constructed on the longitudinal system. Bulkheads fore and aft separated the coal bunkers from the engines and boiler-rooms, and an iron deck above joined the tops of the bulkheads. These ships were still paddle-wheel craft, and were fitted with three pole-masts and sails of fore-and-aft rig, and not square-rigged.

But another revolution was to take place in the navy. During the Crimean War unprotected wooden ships were found to be unable to withstand the terrible effects of shell-fire. Guns had been improving to an alarming extent and something had to be done to counteract this danger. The history of the warship may be at any time summed up as attack and defence, even in times of peace. As soon as one type of ship of superior prowess has shown herself, a new method of rendering her incapable begins to be devised by her rivals. When guns improved, then armour-plating had to be invented to enable the ship to endure such smashing blows. When the torpedo, at a later date, seemed to have made the life of the ship intolerable, netting devices had to be called in to negative the attack. When the *Dreadnought* of to-day was commissioned as the vessel that was able to blow any other ship out of the water, super-*Dreadnoughts* must necessarily be created in order to beat her. And so the game goes on. Since, in the present instance which we are considering, the vulnerability of the ship had been so clearly demonstrated, it was resolved to add a protecting armour to wooden warships.

The innovation, however, belongs not to Great Britain but to France, for *La Gloire*, a French wooden frigate, was protected with iron armour, and this novel arrangement has been the cause of the most striking distinction between the merchant-ship and the ship of war. The old mediæval idea of the interchangeability of the two kinds of ships had been gradually disappearing for several centuries, but here at last it was to vanish entirely, so that to-day, apart from minor distinctions, the main difference between the battleship and the liner lies in the fact that the one is heavily armed and the other is not. The preponderating amount of heavy guns is there because the enemy's armour needs all the smashing power that can be obtained.

The action of the French Government seems to have given the British Admiralty something of a fright, so that in 1859 the authorities at last woke up from their mediæval slumbers, and went one better than the French in building not a protected wooden ship, but an ironclad, iron-hulled man-of-war, the *Warrior*, which was supplied with armour 4½ inches thick, her speed being 14 knots. The thickness of armour in the *Warrior* was the same as that of *La Gloire*, and the former had this backed with 18[illegible] inches of timber and an inner skin. So thoroughly did this new idea possess the naval authorities that many wooden ships were cut down and fitted with armour in much the same way as *La Gloire* had been. In the case of the *Warrior* the armour-plates were fastened to the hull of the ship by bolts secured by nuts inside.

But in spite of all these novelties which had been introduced into the Royal navy within so short a time the old sailing idea was dying hard, and it was some time yet before entire confidence was placed in the engines. The *Warrior*, of which we have just spoken, though she was capable of steaming her 14 knots an hour, still retained her lower courses, topsails, t'gallants, royals, and even studding-sails, as well as the usual triangular headsails, being, apart from her character of an ironclad steamer, a full-rigged ship. Perhaps at a time when the clipper ship was almost at her height and was astonishing the world by her marvellously fast passages, the influence of the sailing ship was then too strong to cause the old idea of sails to be abolished. But to us, nowadays, the picture of the *Warrior* with her two funnels standing up boldly into a cloud of canvas strikes one as passing strange, accustomed as we have grown to seeing the entire independence of sail expressed in our modern ships of war.

The *Warrior*, then, in being the first of the armoured ironclads, marks an important stage in the romance of the ship, and with her contemporaries began the passing of the sail, almost the last and final link which connected the ship of to-day with the vessels of the bygone ages. It was only in 1859 that the *Victoria*, the last line-of-battle ship constructed of wood for the British navy, was launched at Portsmouth. This three-decker, carrying 121 guns, served some time as flagship in the Mediterranean, but went out of commission in 1867. She was built for screw propulsion, and had a speed of 12 knots, but her character belongs much more to the time of Nelson than to to-day. The *Victoria* represents at once the ending of the old régime and the beginning of the new. The former reaches straight back to the Stuarts and Tudors, and so to the carracks and round-ships of history. The latter stretches out to the *Magnificents*, the *Lord Nelson* class of battleship, the *Dreadnoughts*, the super-*Dreadnoughts*, and into the terribly complicated future which no man can guess. As in the merchant ship, so also in the navy sentiment clings round the old rigged ship with her yards and canvas; but sentiment has to give way again to practical utility if the nation and the Empire are to be protected against the threatenings of the foe. For, after all, ships are, like men, created with a definite object of making themselves useful in the world; the sentiments which become attached to them, the glamour of romance, are accidents rather than essentials. The *Victoria* was said to have been the finest line-of-battle ship ever constructed of wood for our navy, and her passing was an occasion of melancholy. Ten or twenty years hence the daily papers will record in much the same strain the passing of the *Dreadnought* from the service; but it is a principle that no ship is indispensable in the course of time, and that the ship that isn't yet launched will far outstrip the one that is being towed to join the obsoletes in the maritime "Rotten Row."

But we must not make the mistake of presuming that the whole of the British navy became suddenly transformed into a collection of iron-hulled craft. It was only during the decade when the clipper-sailing ships were reaching their high-water mark of success that the new type of naval vessels was coming into being, and even still prejudice against iron was very strong. There were still plenty of wooden ships in the royal navy that had been fitted with engines and propellers; even corvettes, ship-rigged, with yards as high up the mast as royals, and with the old-fashioned bowsprit, were important units of the fleet till the 'seventies, or at any rate the late 'sixties. With her three lofty masts and great yards, her hull painted just as it was in Nelson's time, with the white band and the square black ports and the old-fashioned bow of the sailing ship, she seemed to be a curious mixture of the old and the new, with her funnel belching smoke through the rigging. Those were the days when hulls were built of good, sound wood that was bound to endure, and H.M.S. *Conqueror*, for instance, which had been built in 1833 as a sailing ship, did not have her engines put into her until twenty-six years after her launch. Although her designer in 1833 could have had little idea that she would ever be turned into a steamship, and notwithstanding that her great heavy wooden hull displaced 4300 tons and drew 24 feet of water, yet on her trial runs they eventually got very nearly ten knots an hour out of her, with her propeller making over sixty-one revolutions per minute. The scientific method of designing a ship's hull so as to get the utmost speed and stability out of her was still, however, in its infancy. In the seventeenth century it was practically unknown, and until a ship had been launched the designer was rarely certain as to how much water his creation would draw. During the eighteenth century the French developed a much more methodical manner of arriving at exact quantities, and from about 1860 we in this country, after having groped in the dark for a long time, founded the Institute of Naval Architects and applied ourselves seriously to naval architecture as a special science. Nowadays it is very rarely that a vessel does not come almost exactly to her painted water-line as intended.

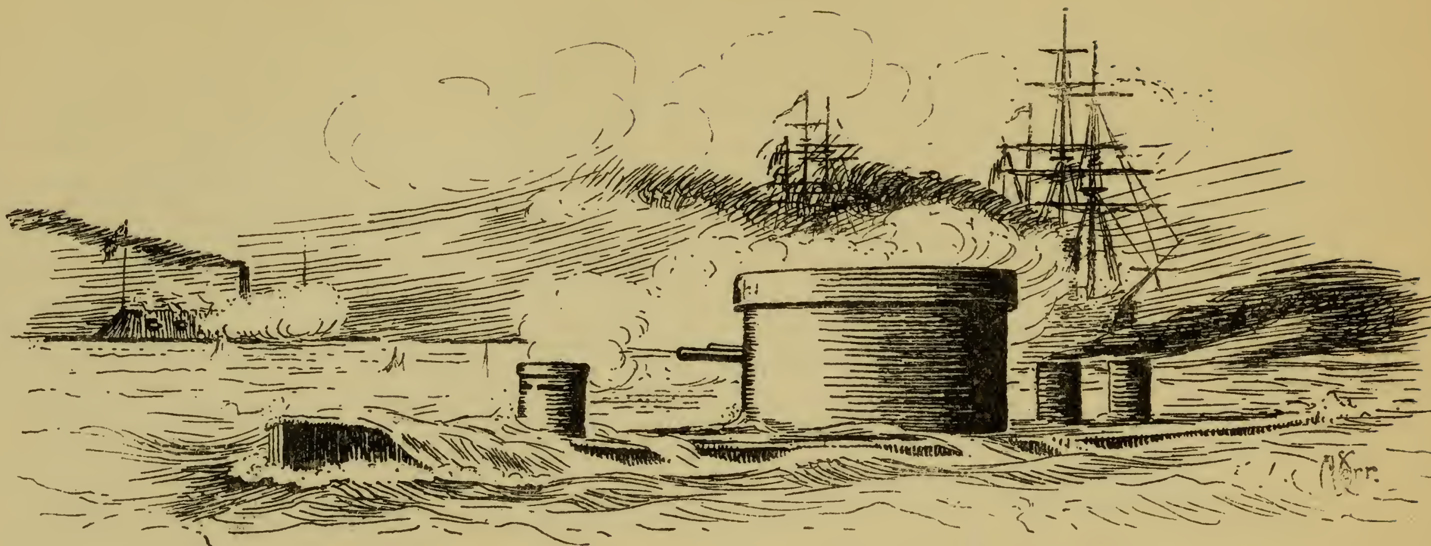
CHAPTER X

THE TURRET MAN-OF-WAR

BEFORE we return to follow the development which was going on in the mercantile marine, we must note very carefully still another revolution in the construction of the warship; and here we may assert that in spite of the many and vast changes which had been going on during the nineteenth century by which the modern ship had been, step by step, getting away from the ship of the Middle Ages, yet now was to come the greatest change of all. The reader will no doubt have long since realised in the course of our story how continually the shipping of one nation has influenced that of another. We saw how the Vikings had dominated our design until the Mediterranean caracks instilled into our minds the idea of building much bigger craft. Later on, especially during the middle of the seventeenth century, the greater progress of the Dutch in the arts connected with the sea had caused us to follow the lead of the Low Countries in shipbuilding, and whenever we obtained any of their ships as prizes in warfare they became some of the most valuable units of our fleet. Still a little later the rise of the French as a naval nation had enabled us to learn much more that was scientific in design, and even later still the very idea of the clipper sailing ships had originated in America.

So now, not for merchant vessels but for men-of-war, we were to go to America for the greatest change of all. The story is briefly as follows. In 1860 civil war broke out in the United States, and this afforded an opportunity of witnessing the first naval engagement between armoured ships. The contestants were the Federals and the Confederates, and the former had burned, or rather set on fire, the *Merrimac*, a 60-gun frigate, in order to prevent her falling into the hands of the enemy. But the Confederates, luckily for themselves, discovered that although she was damaged she was not by any means in a hopeless condition. They set to work, therefore, and determined to make the best of her. Influenced by the new order of things which *La Gloire* in France and the *Warrior* in England had lately set going, the Confederates desired greatly to possess a ship that was armoured, and so they set to work to transform the *Merrimac* into this condition.

They began by cutting the wooden ship down to her water-line and erecting an extensive rectangular vault or "casement" which reached from 2 feet below the water-line to 7 feet above. The sides had a "tumble-home" or slope inwards at an angle of 35 degrees, being made of pine and oak, with externally two thicknesses of armour-plating fastened thereto, and this had been made from railway lines. Piercing the armour were holes for her guns. On March 8, 1862, the *Merrimac*, fitted with steam-engine and a propeller, put to sea and fought the *Cumberland* and *Congress*, which were



THE FIGHT BETWEEN THE "MONITOR" AND THE "MERRIMAC"

It was the *Monitor* which was the first to introduce the now well-known turret principle.

but sailing frigates. The former she sent to the bottom by ramming, and into the latter she poured such a hot fire with shells that the Federal frigate had to give in. But the next day, in Hampton Roads, there was to be given a lesson in naval warfare which the world has not even yet forgotten. Against the *Merrimac* was to come a ship worthy to engage in combat with her, although this fresh arrival was in actual size smaller. Named the *Monitor*, this vessel had been designed and built of iron by Captain Ericsson (whom we spoke of earlier in connection with the invention of the propeller) for the Federal Government. She was 173 feet long on the deck, had an extreme beam of 41½ feet, drew 10 feet of water, and had a tonnage of 614. Protected with iron armour 4½ inches thick, fastened on 21 inches of backing, she carried two heavy guns placed in such a manner that they were parallel with each other *and*—this is the important point—contained in a revolving turret. The *Monitor* was of a curious and original design, for she was only two feet out of the water, her deck and her sides for several feet below the water being plated.

The innovation especially to be noted is the advent of the turret principle. In the olden days when Nelson fought at Trafalgar, battleships were armed so that their guns fired from broadside. When the guns on the starboard side, for instance, were firing, then those on the port side were obviously out of action for the time being. Now the turret idea was to get away from this conception entirely. Placed along the centre line of the *Monitor*, they could be fired on either side as needful, and therefore the ship need not carry a double row of guns—one for either side—for the turret, being moved by means of steam and protected by iron plates screwed together, could be turned round to fire on the enemy from whichever side might be necessary. Furthermore, the *Monitor* presented a very bad target for the enemy to hit, for there was very little of her to aim at. Most of her was under water, her turret was impenetrable, her pilot-house was well armoured, and there was only her funnel to be fired at. In the meantime the *Monitor* herself was able to blaze away with her guns with such devastating effect that the *Merrimac* was forced to follow the example of the corvette of the day before and withdraw from the engagement. So decisively had the turret idea shown itself as a practical tactic in naval warfare that its influence is still felt, and is particularly noticeable in the *Indomitable* class of to-day.

Just as in the year 1812, when Great Britain was at war with the United States, the American frigates had shown themselves so superior to ours that there was a great and sudden craze for adding vessels of this type to our navy, so now the wonderful achievement of the little *Monitor* gave rise to a mighty outcry that we should actually convert our navy into ships of the turret class. The outcome of this in the British navy was the *Royal Sovereign*, the first turret-ship we ever possessed. Originally a wooden line-of-battle ship and a three-decker, she was now cut down, plated with armour, and fitted with four turrets, each of which contained two 9-ton guns. The *Monitor* had only two feet of freeboard, as already stated, but it was decided to give the *Royal Sovereign* as much as six feet. She was, of course, provided with steam-engines and a propeller. This was in the year 1864, two years after the engagement between the *Monitor* and the *Merrimac;* and in the same year also (1864) was built at Poplar an armour-plated turret-ship named the *Prince Albert*, not for sea-going but as a coast-defence ship. Designed and built by Captain Cowper Coles, R.N., who had ever since the Russian War advocated this turret idea, the *Prince Albert* was not a converted wooden hull, but constructed of iron, with a length of 240 feet, beam 48 feet, draught of nearly 20 feet aft, though less forward, and a displacement of 3687 tons. This was only one of two coast-defence turret-ships, and was followed in 1870 by a couple of large sea-going turret vessels called respectively the *Monarch* and the *Captain.* The former was designed by Sir E. J. Reed, and the latter by Captain Cowper Coles, but there was an all-important difference between the two vessels, as we shall see in a moment.

The *Monarch* had a displacement of 8000 tons, and a speed of just under 15 knots. Her freeboard was as much as 14 feet, whereas the *Captain* had been given only six, as in the *Royal Sovereign;* which was obviously far too little, for whilst cruising under sail with the Channel Squadron in September of the year in which they were launched, a sudden squall struck them, and though the *Monarch* came out of it in perfect safety, the *Captain* heeled over and capsized. It was not the fault of the weight of her armour or of her four 25-ton guns, for in these and other respects, save that of freeboard, she was almost sister-ship to the *Monarch*, which played her part dutifully in the service for many years. But it was this capsizing, and that of the *Daphne* thirteen years later on the Clyde, which brought home to the minds of naval architects the importance of accelerating progress in the important matter of stability.

In the first of our turret-ships, the *Royal Sovereign*, there was an approach to modern conditions of ship-design, not merely in respect of the turret system, but also in the abolition of yards and sails, although she carried three masts, the somewhat thicker funnel which was now in fashion being between the foremast and main. Still adopting the turret system, the Admiralty in 1872 completed three other turret-ships of a modified type, named respectively the *Thunderer*, *Devastation*, and *Dreadnought*. These vessels introduced what is usually known as the "military mast," with a fighting-top in which were placed quick-firing guns; also, instead of the single screw-propeller, they had two sets of engines driving twin-screws, which were found to increase materially the handiness of a ship. These vessels had but low freeboard, following in the wake of the original turret-ship; but for this very reason, when met by a heavy sea, they could not maintain so high a rate of speed, and were exceedingly "wet" in even moderate waves. The *Devastation* was of 9330 tons, and had a length of 285 feet, being protected by a 12-inch water-line belt, whilst armour of the same thickness also protected the central casement, at either end of which were the turrets, which were provided with armour 14 inches thick. At that time she was the most heavily armoured ship in the world. Nor was that mistake made which was the manifest defect in the monitor-ship named the *Huascar*, which had been built in 1865 at Birkenhead as a single-turret ship, and fought with the *Almirante Cochrane* at the battle of Angamos in October 1879, during the war between Chili and Peru, one of the hottest and most exciting duels of naval history. Whilst in the latter there was no "dead sector," so that at a comparatively short distance from the ship there was no point upon which her heavy guns could not be brought to bear, in the *Huascar*, which was eventually compelled to yield to the *Almirante Cochrane's* fire, there were many positions on which she could not bring her guns to bear except by sheering the vessel about at various angles. And since, in the engagement which we are discussing, her steering-gear became disorganised, she was entirely at the mercy of her enemy. As much as one-fourth of a circle in the revolving of her turret was "dead," so that, however much the opposing ship might pour shell into her, there could not come from a quarter of her turret any reply. But in the British *Devastation* the arrangement was made so perfect that the two 25-ton guns which she carried in her two turrets could be brought to bear on any portion of the enemy's ship, and these turrets were perfectly protected.

The *Thunderer*, with her low freeboard, also had two turrets, each mounting a couple of guns, and placed at the ends of the armoured breastwork. She was practically rebuilt at a later date, but as originally constructed she had two 38-ton muzzle-loading guns in one turret and two 35-ton guns in the other. Her biggest guns fired a projectile weighing 809 lbs., which would penetrate 15¾ inches of armour at 2000 yards. It may be worth noting as an interesting comparison that the new *Thunderer*, now being built by the Thames Iron Works at Canning Town, will have ten 12-inch guns, capable of sending an 850 lb. shell through 20 inches of the hardest armour at a range of 3000 yards. The old *Thunderer* was only 9330 tons, but the new one will be 26,000 tons. Thus the old gives place to the newer order of things.

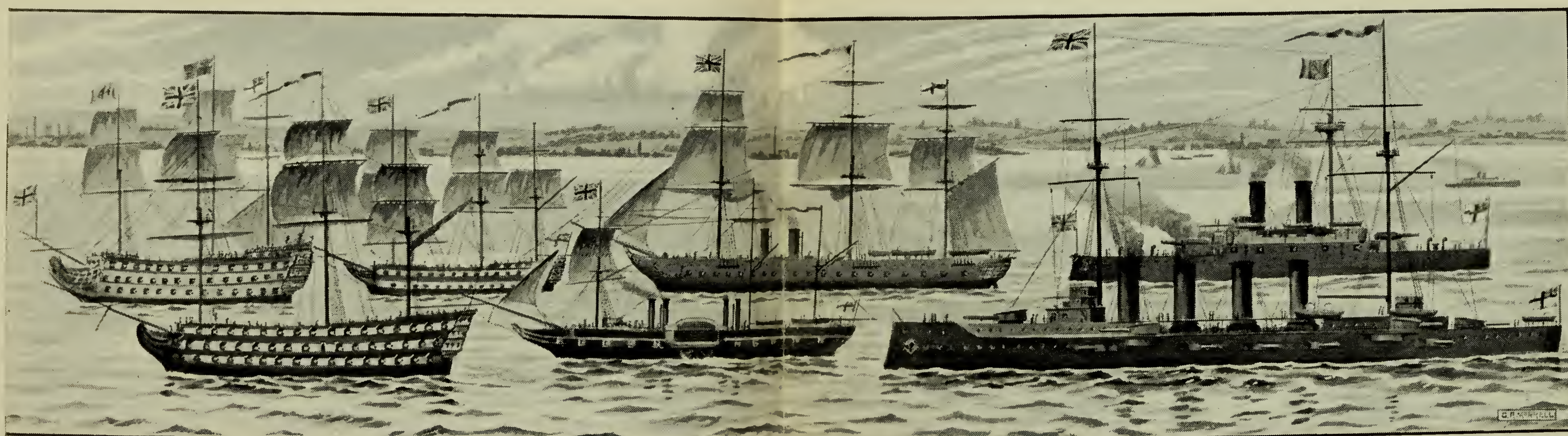
But before we consider further the development of the ship herself we must not omit to note the change which had been going on in regard to the guns of the navy. Since the practice had been introduced of heavily armour-plating a ship's hull, it followed naturally that some important improvements must be effected in the guns. Not enough was it that they had become of larger and larger size and weight, reaching eventually to 100 tons and more, but the old-fashioned smooth bore had to give way to the rifled guns. Rifled guns, as the reader is probably already aware, are constructed in such a manner that the bore contains a series of spiral grooves. The old-fashioned type gave the guns but a limited range and power of penetration, whereas the modern system has greatly increased both, so that in a naval battle to-day the firing will, in the opinion of the most expert admirals in any navy, begin when the opposing fleets are as far apart as 8000 to 11,000 yards. To-day, in the competition which goes on unceasingly between the navies of rival powers, even though no open hostilities exist, there is one continuous fight between the perfection of the guns on one hand and of the resisting capabilities of armour on the other. And for this unceasing struggle we may put the responsibility on the innovation of armour in *La Gloire* of 1859, and of the rifled gun in 1864.

The rejection of the broadside system in favour of the turret idea was not, however, complete, and it was not until the year 1875 that the two last examples of the broadside battleships were built. There was for a time an impression among naval experts that a combination of the turret and broadside systems of mounting guns was the ideal arrangement; but if we assert that from about 1870 to 1887 the turret idea of mounting the guns was the dominating principle, becoming more and more believed in, we shall not err very far from the exact truth. An example of the method of combining the advantages of the two systems may be found in Admiral Halsted's suggestion for a corvette. In this design there was at the top a flying-deck, where the ship's boats were kept. Then came an upper deck with its two turrets, each having a couple of guns, and then the maindeck, where there were placed ten guns to fire broadside.

It was the tremendous size and weight to which guns had now attained, together with the increased weight of armour, that dealt the final blow to the broadside principle of mounting a ship's guns. Therefore they had to be mounted not on either side, but in turrets or barbettes placed on the centre line of the ship. And so we come to still another type of ship known as the "citadel," in which, as in the instance of the *Inflexible*, launched in 1881, the continuous armour-belt running round the ship was abolished and, instead, the armour-plating was concentrated round a "citadel" in the central portion of the ship, which varied from a third to a half of the entire ship's length, the armour extending from about four feet below the water-line to six feet above. The *Inflexible* had plates as much as two feet thick, but her defect was, of course, that her bow and stern portions were unprotected, so that an enemy could have pounded away at these sections and have had little difficulty in holing her. The object of plating so heavily this central portion was to protect the engines, which made this the most vital portion of the ship.

This *Inflexible* was classed as a sea-going turret-ship, and her displacement of 11,880 tons showed the great size to which warships had by this time attained. Propelled by twin-screws, at a speed of over thirteen knots, she had a length of 320 feet. But a year after the *Inflexible* was launched still further modifications were made in this "citadel" type, when six ships of what is known as the *Admiral* class were designed. In these the heavy guns began to be mounted not in turrets but in barbettes. (We may define the difference between the turret and the barbette by saying that the former consists of a circular fortress with a bomb-proof roof, the whole revolving on a cylinder which goes right down to the bed of the ship, the turret enclosing the guns and mountings, and the whole revolving together. But the barbette is a *fixed* circular citadel in which only the guns revolve on a turn-table or cylinder; and a modern casemate, in turn, may be summed up as really a small fixed barbette in which the gun is trained by means of a radial mounting upon that portion of a ship which comes within its arc of fire. In some of the earlier vessels the casemate was just a semicircular protuberance of the upper broadside.) There was also introduced a broadside battery once more, thus proving yet again that the whole history of the ship is but one long chain of revivals. But the reason in this case was not purely arbitrary, and arose from the necessity of having a line of 6-inch quick-firing guns, much lighter, of course, than the others, for the express purpose of defending the ship against the torpedo-boat, which had now been introduced as a dangerous and dreaded unit of naval warfare. But as we shall discuss this particular species of craft in the proper place, we need not here interrupt the continuity of our main story.

As representative of this *Admiral* class of battleship we may take the *Benbow*, which was launched in 1888. Built not of iron but of steel now, she was a very great advance towards the battleship as we know her in the twentieth century. With her hull divided into nearly two hundred compartments, and built with a double bottom, extending not merely immediately below the "citadel" or central portion, but for some distance fore and also aft of this section, she was designed, too, with a water-tight platform over the hold, extending the whole length of the ship, the space between this platform and the protective deck containing the boilers, engines, and magazines. In order to protect her adequately against shell-fire, she was given a belt of steel-faced armour, 18 inches thick, which extended for 50 yards and covered the sides amidships for 5 feet below the water-line and $2\frac{1}{2}$ feet above, whilst across the ends of the citadel bulkheads was fitted armour of 18 inches in thickness. The bunkers for the coal were so placed along the sides of the ship that when full they further protected the inside of the vessel with 9 feet of coal. The *Benbow*, like most of the battleships of this "citadel" type that were built between the years 1877 and 1887, was fitted with water-balance chambers, placed athwart-ship, so as to moderate the rolling of the vessel in a sea-way, thus tending to improve the gunnery. But since then this idea has been abandoned in favour of bilge-keels placed on the outside of the ship's hull, forming a ridge, so to speak, on either side, and running almost parallel with the craft herself. The reader may perhaps have noticed these bilge-keels attached to any models he may have seen of modern liners. The great drawback to the ingenious device of partially filling a cross-ship section with water, to deaden the momentum which a ship obtains when she rolls, lay in the fact that it wasted valuable space, coupled with the fact that the presence of loose water on board was not desirable. It was customary to place these water-balance chambers above the protective deck, right from one side to the other, and experiments showed that 100 tons of water reduced the



THE EVOLUTION OF THE BRITISH WARSHIP DURING THE LAST FOUR CENTURIES

These two pictures afford a rough idea of the general lines on which the ship of war developed from the time of the *Great Harry*, launched in 1514, to the armoured cruiser *Black Prince*, built in 1904, with a tonnage of 13,550 tons. The gradual transition from sail to steam, from wood to iron, steel, and armour is here epitomised.

rolling by 30 to 40 per cent. at angles below ten degrees, but that with increased rolling it was less effective.

The shape of the *Benbow's* barbettes was that of a pear, being in size 45 feet by 60 feet, protected with steel-faced armour, an ammunition trunk plated with armour protecting the charge while being raised from the magazines. In either barbette she was given an enormous gun of 111 tons (breech-loading, of course, by this time), and besides her auxiliary armament, was fitted with a torpedo-tube in the bow, as well as four launching carriages for sending torpedoes from the ship's broadside.

But before we close this chapter we must not omit to call attention to certain improvements which had been taking place apart from the immensely important change connected with the turret development. And first, with regard to the armour. Originally this had consisted of wrought iron, which was capable of resisting the cast-iron projectiles which were then employed. But then the competition between guns and armour became more acute and, instead of iron, steel shot was fired from guns, so that armour of less liability to be pierced had to be found. At first the difficulty was sought to be overcome by using mild steel, but this was followed for some years by using wrought iron protected by a face of hard steel which was welded thereto. This latter was found to break up the shells when they struck, whereas armour consisting exclusively of hardened steel cracked so seriously when fired at that it was condemned. The improved armour was thus known as "compound," because of its combination of iron and steel, and the steel face thus added was found capable of powerful resistance.

But the second important improvement had reference to the guns. In the olden days these had been loaded from the muzzle, and this system was not abolished until the beginning of the ninth decade of the last century. But the reader will readily understand that whilst the old principle was all very well in Nelson's time and as far back as the Middle Ages, yet then guns were still comparatively small. But since by now guns had gradually become longer and longer for the purpose of increasing their range, it was not easily possible to ram the charge well home nor cleanse the barrel after the charge had been fired. Therefore, instead of loading from the muzzle, it was resolved after exhaustive trials that henceforth only breech-loading guns should be manufactured. It was not without much difficulty that the old idea, perhaps the very last survival of mediævalism, was supplanted; for prejudice always has a hard death, and nowhere is this truer than in those affairs which are connected with shipmen. During the 'seventies pressure had been brought to introduce this modern improvement, yet in vain. In Russia, France, and Germany the adoption of the breech-loading gun had been effected for a long time, but it was not until after the year 1880 that the Admiralty obtained what it had so long stood in need of, and the ships which followed the *Inflexible* were provided with breech-loading ordnance, to their materially increased value as war units.

THE TURRET MAN-OF-WAR

There is always some sort of craze or fad which seems to obsess the naval mind in its striving after the highest form of efficiency. We have already pointed out at least two significant instances of this, in the rage for building frigates, and later of building turret-ships to resemble the *Monitor*. At one time during the nineteenth century there was in vogue yet another principle, a survival from almost the very earliest history of the ship. The reader will recollect that one of the essential principles of naval warfare as carried on by the Phœnicians, the Greeks, and Romans, and even later by the Vikings and the English, was to annihilate the enemy by ramming his ship and sending her thus to the bottom. The manœuvre is one involving less science than brute force. However, we who have seen the curious and persistent series of revivals in one shape or another can hardly be surprised to note that the ram was reintroduced after steam warships had become the component parts of the navies of the great civilised powers. The present age sees this revival being again dropped as unsuitable, though there is no telling whether a subsequent generation may not resurrect it once more. There was no denial that the ram, as placed on a heavy steam warship, was a most dangerous weapon. But it was dangerous in two ways—to the ship ramming as well as the ship rammed. In times of peace there were some alarming accidental disasters, and the historic instance of June 23, 1893, when the *Camperdown* rammed and sunk the *Victoria* in the Mediterranean, causing the loss of 339 officers and men, is still fresh in the memories of all who are interested in ships. During the naval campaign of Lissa in 1866, when the warships of Austria-Hungary were pitted against those of Italy, there was afforded an opportunity of gathering most interesting data of the value of the ram in naval warfare, when the *Affondatore*, an Italian ironclad turret-ship of over 4000 tons, suddenly rushed out of the smoke and bore down on to the starboard beam of the Austrian *Kaiser Max*, a wooden ironclad frigate of 3588 tons, and endeavoured to ram her, charging twice and firing each time several 300-pounder projectiles, dismounting an upper-deck gun, putting out of action six men who were at the *Kaiser Max's* wheel, destroying at the same time the engine-room telegraph and a great deal besides. But the latter was able to elude the shocks and to pour such a fire into the *Affondatore* that the Italian was compelled to sheer off. At the second attempt to ram, the two ships scraped together in a sickening manner, and exchanged fire from their small guns at each other.

But a more effective result was obtained when the Austrian flagship *Ferdinand Max*, a wooden ironclad frigate of 5130 tons, was headed at full speed for the port side of the Italian *Re d'Italia*, also a wooden ironclad frigate of 5700 tons, and of the same horse-power as the *Ferdinand*. When two-thirds of a cable away—a cable is 200 yards—the *Ferdinand* stopped her engines, so as to diminish the shock and not do the rammer as much harm as the rammed, and the *Re d'Italia* tried to go full-speed astern, but before she had begun to gather way the Austrian flagship struck her amidships, the

Ferdinand travelling at a speed of over eleven knots. The results are interesting to us who have been noticing the advance made in armour-planting, for it was found that though the section where the Italian ship was struck was that in which her engines were contained, and therefore well protected, yet the armour, its wooden backing, the frames, the beams, and the planking as well, were all crumpled inboard, unable to withstand the awful shock. The hole thus made extended to 300 square feet, and after the Austrian had reversed her engines and backed out the Italian heeled over and sank in 200 fathoms of water. So much for the rammed ship. But the *Ferdinand Max*, although she had rammed with her own engines stopped and her victim practically stationary, yet had her plates at the bows bent and the heads of some of her rivets knocked off and thus sprang a leak. Similarly, during the war between Chili and Peru, already referred to, the *Huascar*, after several ineffectual attempts, succeeded in ramming and sending to the bottom the *Esmeralda*, but in so doing she seriously damaged her bows and sprang a leak. We might also quote the case of the *Independencia*, which tried to ram the *Covadonga* when the latter was within a hundred yards of the beach. The *Independencia* endeavoured to strike an oblique blow at her opponent's starboard quarter, but missed her, struck on a rock, and "piled up."

We could quote further instances, but these are enough to show that in spite of the awful damage which a ram could inflict on the enemy, its value was considerably discounted by its own limitations and the dangerous risks to the ramming ship which the manœuvre involved.

We referred some time back to the *Warrior*. In her the ends, which were not protected by an armour-belt, were divided up into numerous water-tight compartments, so that if she was holed here she would still float. This was a highly useful experiment, and its value has been shown on repeated occasions. Her method of construction was a great advance in shipbuilding, at any rate with regard to men-of-war; and on either side of the vessel was arranged a longitudinal bulkhead placed vertically. The compartment thus formed was water-tight, and was further subdivided horizontally, so that in case of penetration the ship had a good chance of remaining afloat until she was able to make for a dry-dock. But the longitudinal bulkheads also gave an added strength to the ship's structure. It was in this same ship—the first sea-going ironclad built in this country—that a partial double bottom was added. Structural details prevented this bottom being made only partial, but when the *Bellerophon* was launched in 1866 she was fitted with a complete double bottom for about two-thirds of the length. The same idea had already been utilised in the mercantile marine in the case of the *Great Eastern*. The advantage of having an outer as well as an inner bottom is obvious when one considers the possibility of a ship running on a rock, and the practice has since become universal in our big men-of-war. Actual proof of this usefulness has been afforded in several instances when ships have run ashore, as in the case of the *Iron Duke* whilst in Chinese waters, the *Agincourt* when near Gibraltar, the *Apollo*, and others.

Another notable innovation was that of using the steam steering gear. In the *Inflexible* the gear could be used alternatively by hand or steam, the latter being placed entirely below the protective deck, so that when in action the risk of this being shot away was more remote. In ships of the *Admiral* class the steering was controlled by steam or hand power from the lower deck, whilst in an action the steam gear alone was made use of from either of the two conning towers where the fight was being directed, and a sudden order for altering the helm of the ship could be immediately carried out. The use of steam steering apparatus is now so universal, both in the navy and ships of the mercantile marine, that the reader must have long since familiarised himself with its appearance.

CHAPTER XI

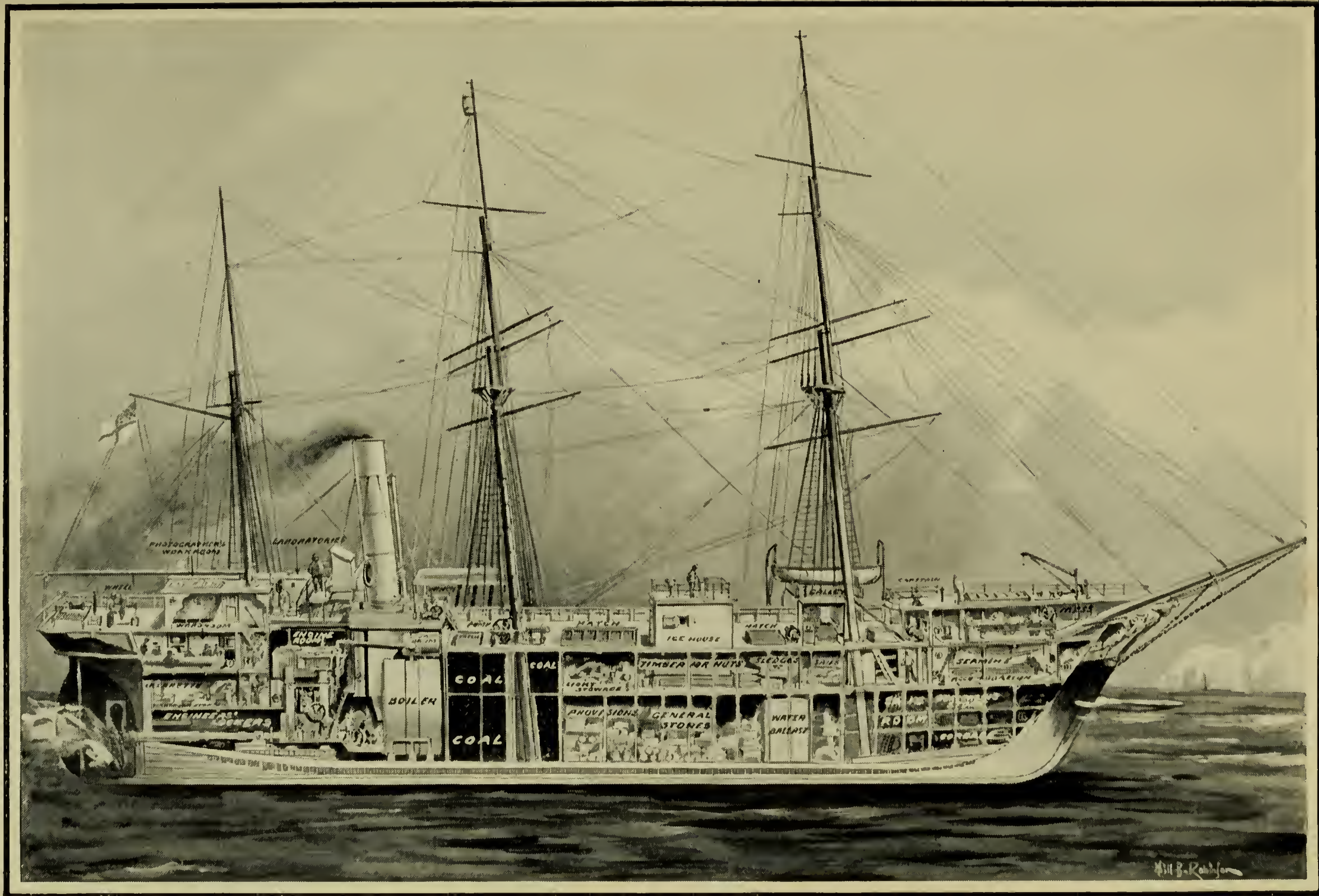
THE EVOLUTION OF THE OCEAN STEAMSHIP

WITH the safe arrival of the *Britannia* at Boston in July 1840 begins that great chapter in the history of enterprise when the Old World and the New were brought into intimate relation with each other for the first time. Prior to this, except for the singularly few instances we have already noticed of any steam-propelled vessels crossing the Atlantic, communication between this country and America had been carried on in sailing ships. What the land-bred passengers suffered on a bitter winter's day, cooped up as some of the less wealthy ones were in the ill-ventilated steerage, while the brave ship was doing her best to thrust herself through gales of wind and terrible seas, with accommodation for the first-class passengers little more than just tolerable, we need not enlarge upon. There were then none of those luxuries which to-day are expected and found on even the smallest passenger ship crossing the deep seas. There was no refrigerating room, no preserved foods had been yet introduced, so the live stock had to be carried on board, often being swept overboard by the swishing seas or dying from the voyage.

But though the experience of making a passage on the first of the Atlantic line of steamships was such as would try all but the hardiest to-day, yet it meant the beginning of the new and more endurable order of things. We hear to-day of so many records being broken that we are in danger of forgetting that the *Britannia* took over a fortnight to steam her way across. But nothing succeeds like success, and the Cunard service had been inaugurated so auspiciously that other vessels had to be added to meet the increasing traffic, which was deserting the old sailing packets and now being carried by steamers. Although it had given so little encouragement to naval steamships, the Government saw that this steam mercantile enterprise should be encouraged; so a new contract was made with the Cunard Company and the annual subsidy increased to £173,340, which enabled them to increase their fleet by four more vessels, one of the finest among them being the *Asia*, a brig-rigged paddle-steamer of over 2000 tons and with a speed of as much as 12½ knots. From the year 1840 this line had the monopoly of the Atlantic trade as regards steam until 1850, when the Collins Line, organised by American merchants, started in rivalry with singularly fine ships for that time, and by their determination to lower the rates for cargo and the fares for passengers, began a healthy competition. But in the end the new-comers left the sea again to the older company.

It is curious how prejudiced the popular mind can be in the face of convincing facts. Although the Cunard Company had as early as 1853 placed six iron screw steamships on the sea, and notwithstanding that the superiority of this newer type of ship had been well proved, yet somehow passengers preferred still the old-fashioned paddle-wheel craft; so after some time it was decided to continue the older form of propulsion, but to make the hulls of iron. It was not until 1862 that the *Scotia*, the last of the paddle-wheel Atlantic ships, was launched. She was a big ship in her day, with a tonnage of 3871 and a speed of 13 knots. Fitted up with comparative luxury, she was the finest merchantman afloat, and reduced the passage between New York and Liverpool to just under nine days, an effort that brings us much nearer to the voyage of to-day. Five years later the paddle-wheel steamer had been abandoned for a much more seaworthy type, and the *Russia*, rigged as a barque, with sails and yards and clipper bow like the finest contemporary sailing ships, was veritably the *Mauretania* of her day. She was built of iron, had a three-bladed screw, and could steam over 14 knots an hour, her fastest passage between Queenstown and New York having been accomplished in a few minutes over eight days.

The North Atlantic ever was the great cockpit wherein have been fought out the battles which determined the supremacy of the merchant steamship. The rush of emigration, and the sudden rise to prosperity of North America after her own civil wars had ended, created an enormous demand for the steamship, long before it plied regularly to the East. For voyages to Australia and India the big sailing ships were still more than holding their own, and there was only a smaller amount of traffic for the steamship on that route, until the Suez Canal was opened in 1870. Even in later years the Atlantic



THE BRITISH ANTARCTIC EXPEDITION SHIP, "TERRA NOVA"

This shows a fore-and-aft section of the ship by which Captain R. F. Scott, R.N., hopes to reach the South Pole. The *Terra Nova* is an old whaler, and was specially strengthened and equipped for her hazardous voyage. The details are explained in the illustration.

has still retained its character as chiefly fostering the progress of the ocean steamship, for a vessel of increased size requires a greater depth of water, and the comparative shallowness of the Suez Canal becomes prohibitive after a certain size is reached. It was, then, the Cunard Company who set the pace and for a long time maintained it single-handed; but competition was growing up. After they had arranged with the Postmaster-General to send a vessel every Saturday from Liverpool to New York, calling at Queenstown, there began to be great eagerness on the part of rivals to secure the honour of carrying her Majesty's mails, so the Government subsidy was reduced and a new arrangement was henceforth made, which is not without interest to the reader, that the remuneration should be henceforth entirely based on the amount of correspondence carried.

But for some years the White Star Line had been engaged in carrying the colonisers from England to Australia, where the great rush to the gold diggings was the cause of considerable passenger traffic from the old country. At first this line had consisted solely of small sailing ships, blossoming out presently into those magnificent clippers which we discussed in an earlier chapter. Then the change was made from wooden to iron ships, but still the White Star flag flew only over vessels propelled by wind and sails. But in the year in which the Suez Canal was opened there was launched for the American route the celebrated *Oceanic*—not, of course, the ship of that name which to-day plies across the Atlantic, but the pioneer steamship of the White Star Company. Propelled by a screw but yet carrying four masts, with yards as high as the royals on the fore and mainmast, the *Oceanic* set forth to overcome some of the prejudice which screw steamships had for some time aroused. The greatest objection against the novel form of steamship was the vibration and jarring of the propeller, especially when, in a sea, the bows pitched, the stern was raised, and the screw being out of the water, freed of any resistance, "raced," to the great discomfort of those who happened to have their berths at the stern end of the vessel. For in the liners of that time the old idea which obtained in the Viking ships, and even the vessels of the Egyptians, still held good, that the place of honour was always at the stern end. It seems amusing that this custom should have remained so long unbroken. The steamships, even when they had reached such perfection, had their first-class accommodation just abaft of the saloon; but the *Oceanic* started a new era in placing the best cabins sufficiently nearer amidships to get away from the propeller nuisance. The old idea, too, so prevalent on the sailing ships, of having high bulwarks, was a mistaken one; for when a vessel shipped a sea the water remained on board, and, in the case of a heavy list in really bad weather, tended to hinder her from righting herself. But the *Oceanic*, besides having "turtle-decks" both fore and aft, had rails amidships, so that the loose water could flow out as easily as it had come on board. The "turtle-back," as its name signifies, is a curved deck without any important structures placed thereon, so that a wave breaking across it is not prevented from washing off again without doing damage on its way.

But in the meantime other lines of steamships had been springing up. The Royal Mail Steam Packet Company had been inaugurated in the year in which the *Great Western* had crossed the Atlantic, but this company was intended for trade with the West Indies. A year before that the Peninsular Line had been founded for carrying on trade with Spanish ports, and three years later had added the words "and Oriental" to their title. But now that we have been able to get a glimpse of the ocean steamship as she was at the time when she became a creature not merely of wonderment but of trust, in which valuable lives and cargo could be despatched safely to any part of the world, across the seven seas, let us go back a little and see the steps which had to be taken before this important stage was reached. We have seen something of the way in which wood was replaced in the royal navy by iron; it will be convenient now to show how it obtained its place in ships of the merchant service.

It was not until 1860 that the Admiralty had an armoured warship built and completed of that material, but many years previously an iron ship had been seen moving across the face of the waters. For as far back as the year 1821 a Mr. Aaron Manby had built an iron craft named after himself, this vessel being 120 feet long and 18 feet wide. She was taken in pieces from Horsley, where she had been built, and was put together again at the Surrey Dock, London, was then tried on the Thames, and the next month left the London river and steamed to Paris, where she continued to ply on the river Seine for the next twenty years. The *Aaron Manby* is thus notable as being the first iron ship that ever put to sea. Manby had secured as helper in his project Captain (afterwards Admiral) Sir Charles Napier, who had financed the same; but commercially the venture of providing iron steamers had not been a success, and Napier became a heavy loser. None the less this naval officer was ahead of his time in endeavouring to obtain some mechanical power to propel a ship independent of sails. Seven years after the *Aaron Manby* had made her little voyage he was allowed to fit the frigate *Galatea*, which he was then commanding, with paddles that were worked by means of winches placed on the maindeck. It was, of course, merely a repetition of Miller's idea experimented with at the end of the previous century. Napier's contrivance was found capable of propelling the *Galatea* at three knots an hour in a calm, and, like the paddle-wheels of the *Savannah* already referred to, these could be shipped and unshipped in a few minutes.

There followed a period, in the early part of the nineteenth century, when the newly invented steamboat suffered a lapse of the greatest depression. Roughly, this may be said to cover the dates of 1827 to 1832, but in the latter year there was a kind of renaissance when Messrs. Laird & Co. of Birkenhead built the *Lady Lansdowne*, with a tonnage of 148, and of course fitted with paddle-wheels. Although the *Aaron Manby* had crossed the Channel in safety, yet she was designed and built as a river steamer, so that the *Lady Lansdowne*, which was to be engaged in the trade between England and Ireland, had the honour of being the first iron steamer expressly designed and built for the sea and not river traffic. But the first really large iron ship was the famous *Great Britain*, completed at Bristol in 1843 in order to be an improvement on the *Great Western*, already mentioned. Such a vessel, with her displacement of 3618 tons, was another record-breaker, and she was possessed of a multitude of interesting features which the limitations of the present story prevent one dealing with. We must, however, in pointing out the great increase in size which this vessel exhibits, show the important influence which she exercised on subsequent ship structure. Granted that, in order to make the crossing of the Atlantic more pleasant and the vessels more seaworthy, the demand for steamships of very large dimensions and displacement was a reasonable one, how was it going to be met? Wood was all very well until vessels were built of such a length, spanning so many feet, that something able to bear the enormous strain had to be found other than wood, which contemporary engineers decided would be altogether inadequate. There was nothing for it, then, but to use iron. It is to the lasting glory and credit of Brunel, the famous engineer, and one of the greatest members of that profession who ever lived, that in spite of the keenest opposition and incredulity, he had the courage to insist on this new material being used for this *mammoth* ship, as she was in comparison with existing craft. The prejudice against iron for shipbuilding was still alive, although some small iron ships had shown their worth. But so daring was this much bigger project that no contracter could be found willing to undertake the building of this ship, so the Great

Western Steamship Company constructed her themselves. Furthermore, she was not propelled with paddle-wheels but with a screw, and for the settlement of this last point we may trace the influence of the *Archimedes*, already discussed, when that vessel had arrived at Bristol, where the *Great Britain* was built.

In appearance the *Great Britain* was not a little curious. Provided with one single funnel, she had no less than six masts and the usual bowsprit and head-sails. On all her masts she was rigged as a fore-and-aft schooner, except that her second mast carried yards and square-sails, these latter having been no doubt retained for convenience in running before the wind in bad weather, there being nothing better than this kind of sail for such conditions. The fore-and-aft sails would be especially useful when on a beam wind—that is, with the wind on the side of the ship, and not astern. Her average steaming speed was over nine knots, and she did good service also under sail power, for on one voyage across the Atlantic, when her propeller broke and she had to trust solely to sails, she attained a speed of over ten knots an hour. It was this vessel that had the misfortune to get ashore in Dundrum Bay off the coast of Ireland, where she remained throughout the winter exposed to the terrible weather and battering seas; but though she remained in this plight for eleven months and endured the fury of the south-westerly gales, being almost entirely below the water at high tide, yet, thanks to the artificial breakwater which Brunel, her designer, had built temporarily round her, and thanks also to the excellence of the construction of the ship herself, she was at length finally refloated. On arrival in Liverpool she was sold, her engines replaced with a newer type, her masts reduced by two, and for nearly thirty years she plied her calling on the Australian route. Her last stages of existence may be summed up thus: After 1874 she was transformed into a sailing ship entirely and her engines taken out of her. She next became a coal-hulk off the Falkland Isles, and after fifty-seven years of much usefulness was brought back to England again and broken up.

But the *Great Britain* had proved that Brunel's courage was justified, and the fact that she had endured so long the experience of Dundrum Bay showed that there was a good deal to be said for the building of iron ships. Iron ships of all kinds, therefore, began to be built, for coasting and for cross-channel service as well as for ocean steaming. It was in 1858 that another and much more important ship was to be completed, whose size was for a long time one of the wonders of the world. This was the *Great Eastern*, whose enormous displacement of 32,000 tons, when loaded, was not surpassed for many a year—not, in fact, until the White Star *Baltic* was built in the year 1905. The mere fact that she had accommodation for 4000 passengers, as well as a crew of 400, will alone afford some idea of her hugeness. Like the *Great Britain*, she was also fitted with six masts, but no bowsprit. She was schooner-rigged except on her second and third masts, where she carried yards and square-sails, and was provided with five funnels—a truly extraordinary sight even if she were afloat to-day. The design of this monster was the outcome of the combined brains of Brunel and Scott Russell, another famous engineer of the nineteenth century. Propelled by paddle-wheels, in addition to a screw, it was thought she would develop considerable speed, would be able to carry all the coal she needed between here and Australia—we must remember that the Suez Canal was still unopened—and would, by reason of her superiority to any other ship afloat, be able to attract all the cargo her holds could obtain, and would thus be a very valuable investment as a commerical concern. That she was gigantic not merely as a steamship but as a financial failure is now an historic fact, and those who took interest in the superstitions of the sea and its ships saw that in the fruitless attempts to launch her there was the beginning of her bad luck thus early in her career. The first endeavour to make her take the water was in the first week of November, and it was not till the following January, involving a loss of a fortune and the winding up of the owning company, that she was afloat. By this time her owners had had enough of her and she was sold to another company, who, instead of running her to Australia, placed her on the Atlantic, where, as mentioned before, the great competition among steamers was being waged with consummate zeal.

Another sailor superstition of ill omen was connected with the fact that, after being originally called the *Leviathan*, her name was changed to that by which she became famous. As a passenger ship she was found unremunerative, and her revenue as a cargo steamer was equally disappointing, so from 1865 to 1873 she was transferred to the work of laying the Atlantic submarine telegraph cables, when she retired on her scanty laurels, and was finally broken up by 1890.

But as a ship rather than a successful financial venture the *Great Eastern* is full of interest. A house of 50 feet high is a pretty tall construction when you look up at it, yet the actual diameter of this ship's paddle-wheels was 56 feet, and each wheel weighed 90 tons. Under this form of propulsion alone she could steam 7¼ knots, but with screws working as well it was estimated that she could go ahead at about double that pace. A trial trip with screw alone showed her speed to be 9 knots, but the fullest speed which had been contemplated, using both paddles and screw, was unattainable, owing to the excessive resistance which these caused for their respective engines. It is worth while mentioning that to Brunel was due this innovation of using both forms simultaneously. Like the naval ships we discussed in a previous chapter, the *Great Eastern* was fitted with iron bulkheads, and from the keel to the water-line her hull was double, with a space between the two skins of nearly three feet. The advantage of having an outer as well as an inner bottom was shown when the *Great Eastern* had the misfortune to run on a jagged rock. Although it was discovered afterwards that she had been holed for a distance of about one-seventh of her entire length, yet she completed her voyage in safety without any water leaking in, thanks to the fact that her inner bottom was sound and seaworthy. This cellular system, now employed so largely in steamships, is not merely advantageous in the event of running ashore on some hard substance, but it actually adds strength to the ship's structure. Furthermore, as the end of a voyage is reached and the coal bunkers gradually become lighter, the balance in weight can be compensated by admitting water as ballast into the spaces between the inner and outer skins. Whatever strictures may be justly levelled against the mistake of inaugurating a new system by building a vessel of such singular character as the *Great Eastern*, it cannot be denied that she was constructed with the greatest ingenuity and of remarkable, enduring strength, and some of the experiments thus shown to be justified were put to practical use thereafter.

From about 1862 to 1884 the great ocean liners were fitted with single screw (and also sails), and practically all these ships were built of iron. Since the days of the *Comet*, so many improvements had been made in marine engines that the former defects of steamships had now been overcome. These defects have been already referred to and may now be summed up in two words—waste and want. The waste was in respect of the extravagant amount of fuel which these first steamers burned, making them less remunerative to the shipowner than the sailing craft. The want was in regard to the amount of steam-power developed. These two drawbacks were gradually overcome, so that engines capable of developing higher pressures, with a saving at the same time of about half the quantities of coal consumed, made the adoption of the steam-engine profitable indeed. As the engines gradually came more nearly to perfection, so the public confidence in them increased, and the steamship met with full patronage. The apotheosis of the liner was already in sight.

But simultaneously with the improvements going on with reference to the purely engineering part of the ship there was being solved—or, rather, strenuous attempts were being made to solve—the difficult question of ship design. We say "attempts" advisedly, for in spite of the experiments and conclusions of the late Mr. Scott Russell, of Mr. Froude, and others in determining the exact relations between the moving ship and the resistance which she finds in travelling through the water, the last word has not yet been said, though with the steady increase of experimental tanks, not merely in this country but in America and Germany, the next few years will no doubt see most valuable data added to our stock of knowledge. But already careful attention had been paid to such interesting problems as the resistance which a big-bodied ship makes through the amount of immersed surface, through the eddies which cluster round her stern after she has passed through any given portion of water, and finally the cumulative effect of waves and the manner of best counteracting this. As speeds increased to such figures as the sailing ship had never attained before, it was obvious that new calculations would have to be made in the design of the hull, for, as the reader is perfectly well aware who has watched a fast steam-launch or motor-boat, the wave made by a slow craft and that by a high-speed vessel are very different. Therefore when each successive year saw one big ship brought out to beat its predecessor, it was not merely and entirely a question of putting in the greatest steam-power, but also of diminishing, if possible, the resistance to such a craft as she sought to get over the water. Thus a new chapter had opened for the naval architects, caused by the introduction of new conditions.

Furthermore, the actual structure was being considerably modified. We have already spoken of the introduction of iron, and of sundry other alterations to strengthen and make more seaworthy that beautiful creature which the turbulent sea loves to play with as with a toy. But there was to be yet another change, and this was from iron to steel, a change that has swept through all classes of shipping, except those which for special reasons are still built of wood. Steel had been used more or less tentatively during the 'seventies for shipbuilding, but it was not till the 'eighties that its real introduction had come about. So successful has its adoption been that, according to the figures before me of the ships built during the past year, not one single sea-going vessel was built of iron, but whilst a number of small craft were constructed of wood, the rest were entirely of steel. That in itself is proof enough that the advantage of steel over iron is incontestable in these days when competition is keen and freights are low. But the reasons for this preference of steel are as follows.

"Mild" steel—that is, steel which is by its nature very soft and malleable and easily capable of being "licked into shape," to use a form of slang that is particularly applicable here—was found also to be superior in strength to iron. These two advantages, ductility and strength, as soon as they became known and the usual prejudice had died down, opened up a new era of shipbuilding. It was also lighter than iron, and thus the hull weighed actually less than that of an iron-built ship. Even when accidents occurred of such a nature that the iron ship would have broken, it was found before long that the steel ship at the worst would only bend; and if only it had been found at an earlier date that there was a method of manufacturing mild steel at a moderate price, there is little doubt but that it would have been introduced to the shipbuilder far sooner than actually was the case. The royal navy, which at one time we saw to be lagging far astern of the merchant service in its appreciation of modern inventions, had already adopted the use of this metal long before it was tried in trading ships, just as the navy had gone ahead in its development of ships with bulkheads and double bottoms. When speed became each year so important a factor in the prosperity of the merchant ship, in order that passengers, perishable foods, and royal mails might, as was necessary, be hurried across the ocean with the utmost despatch, the saving in weight which steel brought with it was a most powerful incentive to its being adopted. The first ship on the Atlantic route to be built of this material was the Cunard *Servia*, which was the largest and most powerful steamship that had been yet seen, excepting the *Great Eastern*. In her, too, was introduced the use of incandescent electric lamps in place of the old-fashioned smelling oil-lamps, whose odour was not consoling to the unfortunate passenger prone to sea-sickness. This was in the year 1881.

The next stage in the advancement of the ocean steamship was to use not the single screw but twin-screws. In smaller ships this had been done for some time. As far back as even the year 1804 a twin-screw steamer had been built and tested in America on the Hudson, but not successfully. It was not until 1888, when the well-known *City of Paris* was launched for the Inman Line, that a big ocean liner fitted with twin-screws was seen. The advantages are so obvious that it is remarkable that for so long these were not adopted in preference to the single screw, although it is only fair to add that the navy had already recognised their superiority. Apart from the fact that this system makes the manœuvring of a ship easier, there is that other great consideration of safety, for the big liner represents an aggregation of enormous wealth—of hundreds of human lives, of valuable hull, engines, cargo, fittings, and perhaps mails. In the by no means rare occurrence of the rudder being carried away, or of a propeller shaft becoming fractured, the single-screw liner is helpless, and it may be impossible to keep her head riding to the sea. Supposing it is really bad weather and she gets beam on to the mighty mountains of Atlantic waves, what is to prevent her from being washed about, as sailors would say, "like a half-tide rock"? At the best, although the brilliant efforts of the engineers have at times made remarkably effective repairs, enabling the crew to get the ship into port, the valuable ship is wallowing about, a splendid prey to the first steamship that comes along aud tows her home. She may be capable of towing or she may not. In all probability the accident happened in bad weather, in which case to get tow-ropes aboard the other may be difficult enough; but that is capped by the almost certain probability of the ropes breaking, leaving the disabled ship as helpless as before. But granted that she is towed safely home, it is not all satisfaction then, for there will be a very heavy compensation, running into thousands of pounds, to be paid the owners and crew of the other ship for salvage work.

Now with a twin-screw ship, if one propeller shaft breaks down, the other screw is still serviceable, even with a loss of speed. Or, again, if the rudder becomes damaged or the steering gear put out of action, the ship can still be steered by means of the screws, and an instance of one of the big liners doing this latter evolution occurred whilst this present book was being written. She had encountered bad weather in the Atlantic, but succeeded in coming safely up Channel with her rudder disabled, informing her owners by wireless telegraphy of what had happened. But to-day the use of twin-screws is almost universal on ocean-going steamships, and on many other smaller steamers as well.

But the twin-screws of the *City of Paris* were not at first found to be as satisfactory in regard to speed as if she had been fitted with one single propeller, and it may be said, without fear of contradiction, that even at the end of the first decade of the twentieth century the complete understanding of the screw in its relation to speed has not yet arrived. The experiments made with the screws of the *Mauretania* are evidence of this. It is impossible here to describe in detail all the special features of the *City of Paris*, with her water-tight compartments, and other points of interest which at the time of her launching were so remarkable, but it is worth noting that such an accident as we mentioned above actually occurred to this vessel. In May 1890 she had the misfortune, whilst bound across the Atlantic to England, to break her starboard propeller shaft, doing all sorts of injury to the ship internally. It was also this same vessel which ran on to the Manacles near Falmouth. She is now one of the fleet belonging to the American Line, which absorbed the old Inman Line of steamships, and, under her changed name of *Philadelphia*, is still to be seen starting from Southampton and threading her way through the narrowing waters of the Solent out through the Needles passage, bound to America.

CHAPTER XII

THE MODERN LINER

IT is with the advent of the *City of Paris* and the *City of New York* (now called the *New York*) that the highly developed liner, with all her complex features, begins. With the coming of these two ships vanished the sails which for so long had been retained as auxiliaries. But now that twin-screws had come to stay, there was no need to retain this last link which connected the liner of to-day with the old square-rigged sailing ship of the time of the clippers and away back into the long vista of history. Yards and sails were now obsolete, and so in the two White Star ships *Teutonic* and *Majestic*, launched the following year, although there were originally three pole-masts with gaffs on each, this equipment has since been modified by abolishing one of the masts and altogether abandoning the gaffs. In the new *Olympic*, now being built for the same company, there will be only one mast left to carry on the tradition.

We have seen on another page how the ship for mercantile purposes has gradually got away in the course of time from the ship for carrying on the arts of war. It was inevitable that this should be so as long as circumstances continued to alter and the ingenuity of man continued to be exercised and employed. But in the 'eighties there began to be a slight return to the relations which in former days had existed between the two kinds of ships. To employ a man-of-war nowadays as a carrier of freight and passengers is, of course, unthinkable; but to employ a crack liner as an armed cruiser was not only deemed possible in the event of war, but the *Teutonic* and *Majestic* were, as a result of arrangements made between the Admiralty and the White Star Company, specially constructed with this intention in view, whensoever the time for their conversion might arrive. It had been pointed out to the Admiralty for several years that a fast ocean liner might prove herself of considerable value in the time of war; but big bodies move slowly, and it was some time before the naval authorities could appreciate the point. These ships, then, were so arranged that they could carry a dozen "four-point-seven" guns. The ships were to be manned by crews of which one-half were to be naval reserve men.

On her first trip across the Atlantic the *Teutonic* crossed from Queenstown to New York in 6 days 14 hours 20 minutes, this being then the quickest maiden passage on record. The *Majestic* in the following year even eclipsed this by about four hours. But it is well known that a liner takes time to find her own capabilities, and it is not for a year or two that the best that is in her is displayed. Not till two years had elapsed since her first voyage did the *Teutonic* reduce the Atlantic record to 5 days 16 hours 31 minutes, showing an average speed of 20·35 knots per hour, which was about three hours shorter time than the best passage of the *City of Paris.* Although of less than ten thousand tons, these two ships were in their time second to none for the excellence of their build, engines, equipment, and comfort of the passengers, and to-day they are still popular, although in size and speed, and luxury as well, they have been long since surpassed by other steamships. The ships that have since excelled them have been for the most part improvements on these rather than of different types. Speed was, as just shown, one of the most obvious considerations, but not to the exclusion of everything else. In spite of the proud honour won by the *Mauretania* and *Lusitania* in the thrilling attainment of twenty-five knots, yet pace is not everything, and there is being manifested now a tendency to regard twenty-one or twenty knots as quite adequate for a first-class liner. The enormous increase of coal consumed in order to obtain but a slight increase in speed is out of all proportion to the total advantage obtained. The matter is instantly made clear when we state that, supposing a ship is driven twelve knots an hour by burning ninety tons of coal per day, yet by doubling the quantity of coal consumed you would increase her speed not to twenty-four, but only to sixteen knots per hour. And still less will you profit in proportion when you increase your coal consumption to three hundred tons, for then the utmost you can get out of the ship is twenty knots. The principle is that the amount of coal burned varies as the cube of the obtained speed. The *Majestic* burns about three hundred tons a day, and in the event of the Suez Canal being closed she could steam from Portsmouth to Bombay, round the Cape of Good Hope, a distance of 10,730 miles, without having to coal on the way, the passage being done in twenty-two days. As an interesting comparison it may be stated that the coal consumption of the *Mauretania* is about a thousand tons per diem.

The answer to the building of the *Teutonic* and *Majestic* came from the Cunard Line with the *Campania* and *Lucania* in 1892 and the following year. These fine ships exceeded their rivals of the White Star Line in length, breadth, tonnage, and speed. The twin-screw system was, of course, continued, and the average pace of the *Campania* from New York bound east, for a twelvemonth, was just under twenty-two knots, that of the *Lucania* being less. Rigged with pole-masts, two in number, and without yards or sails, these Cunarders, like the two White Star liners just mentioned, were also built under Admiralty supervision for use as armed cruisers should occasion arise. The *Lucania* has since ended her days, but the *Campania* is still one of the finest liners afloat. Three out of her four decks are built of steel, and there is also a wood-sheathed promenade deck made of the same metal. In spite of her enormous length of 600 feet, the *Campania* can put her rudder "hard over" when going at full speed and turn round in her own length. This is a remarkable fact when one considers that here is an enormous ship, displacing considerably more than nineteen thousand tons, yet capable of being handled as easily as a small steam-launch.

Since steel had first been employed for the building of ships, some real and valuable advances had been made in the methods of its manufacture. In the building of these two liners these fresh advances were fully utilised. It was found, for instance, that the manufacturers could now turn out steel plates of much larger sizes, and the immediate benefit of this to the shipbuilder lay in the fact that less work was required and fewer rivets had to be employed. Following up the custom introduced by the *Oceanic*, the first-class passenger accommodation was arranged in the centre of the ship. The luxury of the *City of Paris* and of the *Teutonic* and their successors was further advanced another stage. Fire-grates in passengers' quarters were fitted as in shore dwellings, the steerage quarters were made far more comfortable, and an effective device was fitted for regulating the engines so as to prevent the racing of the screws when the bows of the ship pitched and the stern was raised out of the water. This was an advance in the direction of both safety and increased comfort.

With the *Campania* and *Lucania* the British flag was seen flying on the fastest and finest of the ocean liners until the year 1898, when the *Kaiser Wilhelm der Grosse* came on to the scene. Future historians will have the difficult task of assessing at its full value the activity of the nineteenth century, but of the many features of interest and importance few will be found of a more striking character than the sudden rise of Germany both as a prosperous commercial nation and as a first-class naval power. With the latter we have neither space nor intention to treat here; but in the development of the ship we are compelled to turn our attention momentarily from our own country, across the North Sea, to the country possessed of a limited coast-line but unlimited incentive and powers of enterprise. The first iron shipbuilding yard was not established in Germany until the year 1851 near Stettin, and it was not until four years later that the first German-built iron ship was launched. Until the Franco-Prussian war had been brought to a conclusion and the German Empire had been founded, it had been necessary to go to England for the best shipbuilding. The high regard which was paid to the excellence of British ship construction all the world over brought to our country a continuous supply of the best orders. To learn a new trade always involves the expenditure of much valuable time as well as money. To lay down properly equipped shipyards, with all the costly appliances essential for the building of first-class ships, would have been absurd and unwarranted until such time as the country had progressed to a further stage; but in the meantime Germany had resolved to make a bid for a large share of the world's business carried on in ocean-going ships. There was no alternative, therefore, but to take advantage of the pre-eminent position which Great Britain occupied in the shipbuilding world. The best German ships, then, were the result of British brains, labour, and material.

But from about the year 1879 the German Government determined to subsidise mail steamers of their own, and the building of these was begun near Stettin. Henceforth German ships were as far as possible to be built by German shipbuilders, and competition from a new source was to begin. Only two large passenger steamers had been built in Germany, but the North German Lloyd Company lent its encouragement to its own country, and other companies followed in their wake. At last magnificent new ships of great tonnage and considerable steam-power were being constructed in the newer empire, and by the time the *Campania* and *Lucania* were achieving their triumphs the Germans had progressed so far as to be preparing plans for a new express steamer which should in speed, at least, surpass the two Cunarders. The outcome of this is seen in the *Kaiser Wilhelm der Grosse*, which was 25 feet longer than the *Campania*, and of greater displacement by more than a thousand tons. The latter also exceeded the *Campania* in the matter of speed, so that the "blue ribbon" of the ocean was held not by England, but by Germany, until the wonderful feats of pace were achieved by the *Mauretania* and *Lusitania*. Unlike the ships of our country, these foreign vessels were so arranged that each group of boilers was placed in a separate room, being self-contained by separate water-tight bulkheads. The first-class passengers were located in the centre of the ships, the stern being reserved for the second class and the forward end for the third class, whilst the different companies of the crew were distributed in various parts of the ship, in order to be placed as near as possible to the locality of their usual work.

In 1901 the success of the *Kaiser Wilhelm der Grosse* was followed up by the *Kronprinz Wilhelm*, and two years later by the *Kaiser Wilhelm II.*, which showed a speed of about twenty-three knots, a truly marvellous achievement for any ship to attain, but still more wonderful when we bear in mind the celerity with which the German naval architects, engineers, and shipbuilders had reached such remarkable proficiency. The latter had been given a problem to solve of the greatest magnitude, and even to attempt such a task demanded no little courage. When the contract was made for building the *Kaiser Wilhelm der Grosse* it was even stipulated that the ship should be required to prove her entire efficiency by a trial trip across to New York, and if during that voyage she did not come up to the standard which had been set, the North German Lloyd Company was to be permitted to decline to accept the vessel from the shipbuilders. It was immediately seen, however, that the highest expectations had been fully realised.

To come back now to the progress of British shipping, which still remains at the head of the world's list—for in 1909, of the amount of tonnage classed at Lloyd's, over 76 per cent. was built in the United Kingdom, Germany of the other countries contributing the next largest amount, followed by Japan with but a short interval between—let us see briefly what have been the characteristics which have marked the development of the liner during the last few years, and up to the present time. In order to keep the subject within the limited scope of our inquiry we must necessarily confine out attention to main points, but we shall be able to arrive at a fair estimate of the last stages in the long career of change which has marked the story of the ship in her mighty efforts to become the trusty and capable servant of man and his commerce.

We address ourselves first, then, to the second *Oceanic*, built for the White Star Line in 1899, a worthy upholder of that name which the pioneer steamer of this company had had bestowed upon her when she first took the water. Seven feet longer than the *Great Eastern*, but about fifteen feet less beam, she was not intended to be as fast as either the *Campania* or the *Kaiser Wilhelm der Grosse*, though of greater tonnage than both. But the *Oceanic* also was, and remains, a wonderful piece of engineering skill with her seven decks of lower orlop (beginning from the lowest), orlop, lower deck—the last mentioned on the water-line—with middle deck, upper deck, promenade deck, boat deck, and captain's bridge towering above the sea. She is built of exceptional strength, with a double bottom as usual, her plates being fastened with rivets of unwonted size, of which more than two million were used up before the ship was completed. In her the costly striving after excessive speed was not thought necessary, or held to be compensated by the amount of superiority obtained in return, though the long, narrow form of the hull is conducive to pace in the highest degree. We drew attention in the case of the first *Oceanic* to the introduction of the turtle-decks for the bow and stern, and referred to the function which these were intended to serve. As long as liners remained of moderate size this tended to make the ship of greater seaworthiness; but, as we have seen, the liner had gradually risen higher and higher out of the water, attaining such a height, even at her gunwale, that her freeboard was now unlikely to require decks of this shape. In this second *Oceanic*, therefore, the turtle-decks were conspicuous by their absence.

Thus we come to the end of that eventful nineteenth century which had seen the steamship first travelling over the seas. In spite of all the ill-conditioned prophets of evil who said that a marine steam-engine was preposterous, and only modified the statement later to the effect that at any rate a steam-propelled craft could not cross the broad Atlantic in safety, the victory had been won and the worst expectations of the pessimists had been unfulfilled. We have seen in like manner that the scorn which greeted the suggestion that iron should be used for building the hull of the ship was utterly unjustified, and subsequently that the prejudices against steel and the adoption of the twin-screw system were but the imaginings of those whose thoughts were of the present rather than of the future.

In like manner the engines had gone on in their development. The low-pressure engine, with a wasteful expenditure of coal and a minimum of steam-power obtained, had been followed by the compound engine, in which the steam generated could be used more than once before being finally discharged into the condenser. Coal consumption was reduced, more pressure was obtained, and increased speed accordingly. When the reader is reminded that it is no extraordinary thing for a big steamship to burn seven or eight hundred tons of coal a day, it will be seen that the possibility of being able to economise in fuel was a consideration of the utmost importance. The compound engine was followed by the triple-expansion engine, and the latter in turn by the quadruple expansion. It was the advent of the compound engine, indeed, which, introduced in 1854, though not adopted universally for another twenty years, enabled the steamship to achieve such wonderful passages as startled the whole world. Without leaving the domain of ships to trespass on that of practical engineering, we may, for the sake of clearness, state briefly that the working of the steam-engine is just this: By means of heat applied to the boiler containing water, steam is generated, and is conducted thence by means of pipes to a cylinder where it is admitted to drive the piston. Afterwards the steam passes to the condenser, where it is converted again into water and pumped back again into the boiler, and the process repeats itself again.

Now by using more than one cylinder, so that the partially expanded steam may be able to do some additional work before it is discharged finally into the condenser, it is obvious that a great saving is obtained, and the value of the ship fitted with this type of engine is far greater than hitherto. The triple-expansion engine is but a further development of the compound principle, and the modern use of the quadruple expansion is but a stage advanced further still. The first *Oceanic* had compound engines; the *City of Paris* introduced the custom of having two sets of triple expansion; the Cunard *Ivernia*, built in 1900, was given quadruple expansion, whilst the *Kaiser Wilhelm II.* has four, instead of two, sets of these.

But now we open up the last and, at present, final phase of the steam-engined ship. This comes with the year 1905, when the Allan liner *Virginian* was the first ship fitted with turbine-engines to cross the Atlantic. The same year the Cunard *Carmania*, a vessel of slightly under 20,000 tons, having been built not with twin screws but triple, and provided with turbines, paved the way for the *Mauretania* and *Lusitania* which were to follow. Before we explain the action of the turbine, let us remark that the adoption of this kind of engine means a great saving of weight as compared with the reciprocating engine, and, what is equally important, a similar saving of space. Additional advantages are found in the fact that the turbine causes no vibration, but it is by no means certain that it is as economical as the best triple expansion. The perfecting of this system is one of the problems which the present or the next generation will have to solve.

We cannot here do more than say quite briefly that the working of the turbine is much the same as that of the water-wheel which gives the power to the mill. Instead of water, however, steam is used. That in one sentence shows the idea stripped of all technicalities. Put more fully, we might go on to explain that a flow of steam comes out on to the turbine wheel or "rotor," as it is called, the latter being mounted on the propeller shaft direct, so that no rods or levers are necessary. The wheel is provided with a series of small curved blades, between which the steam flows, and as this wheel revolves so also must the propeller. The principle of this invention is exceedingly old—the ancient Greeks certainly knew something of its nature—but it is to improvements made by the Hon. C. A. Parsons that its modern success is due.

Like many other good things, the turbine has the defects of its qualities, and one of its greatest drawbacks lies in the fact that it can be rotated in one direction only. But a liner that cannot go astern is of little service, so that this difficulty has to be got over either by fitting also slower engines of the reciprocating type, or by adding turbines for revolving astern only.

With the completion of the mammoth *Mauretania* and *Lusitania* and their admission into the large and illustrious family of the liner, there seems to be but the thinnest connection between them and that first floating craft which we saw at the beginning of our story. When the character of these two wonder-ships is still fresh in the minds of all who note the events of the day, it may seem unnecessary to add more words expressive of amazement that the hands of man should be capable not only of making such a creature, but of launching so massive a structure from the land to the water. As the largest, the fastest, and most luxurious ships of any kind that the world has ever witnessed, as the embodiment of the best that could be planned regardless of cost, these two ships are amazing creations. And yet, in spite of their enormous bulk, so beautifully are they designed, so delicate are their lines, that it is not until a moderately large vessel is placed alongside them that their full size is appreciated. Four-funnelled, quadruple-screwed, turbine-propelled, with a speed of 25 knots, a palace inside, and a steel island outside, it is difficult to think of them just as ships. Rather, with each vessel carrying over three thousand passengers and crew, she is a moving town. All the luxuries of Caligula's ships are here, with the addition of high speed, wireless telegraph connection with the shore, a daily paper printed ready for the passenger as he emerges from his sumptuous stateroom and comes down to breakfast in a saloon replete with all the luxuries of the most perfect restaurant. There is nothing omitted which the ingenuity of man or the resources of science could have added to increase the comfort or efficiency of such a ship. Each of these represents a couple of million pounds sterling as a vessel alone. What the value must amount to when mails and passengers and baggage are on board we do not propose to estimate.

As affording some idea of the relative importance which certain departments possess on the latest Atlantic liner, we may mention that each of these ships, besides an army of telegraph, telephone, and lift attendants, printers, cooks, stewards, and bandsmen, carries only seventy sailors, but nearly six times that number in her engineering department. Had it not been for the handsome assistance of the British Government, who agreed to advance two millions of money towards the cost of these two ships, it is doubtful whether we should have seen their like. In peace they are the strongest links between the Old World and the New which have ever been forged. In war their services will no doubt be amply shown when high speed and extraordinary internal capacity are demanded for special use, either for transporting troops or for the carrying of food supplies.

And here we may leave that part of the story of the ship which deals with the modern liner. Bigger vessels than even these two are being built, though the probability of any ship of such dimensions attaining a speed beyond this is highly remote, for the barrier of extra cost is well-nigh insurmountable. Nevertheless, so much has been done, so many changes have taken place which had previously been ridiculed when even hinted, that it would be dangerous to speculate. It may be that, as in the case of the arrival of the steamship at the critical moment when the sailing vessel was reaching finality in rig and speed and build, so the synchronising of the coming of the aeroplane and the perfecting of the liner may be the beginning of the change in mode of travel from the ship of the sea to the ship of the air.

We have now been able to gain some idea of the last development of the steamship as employed for her peaceful mission in bridging over the vast oceans which separate men from their blood-relations. Let us now take up the story of the steam warship where we left it in the previous chapter. Like the liner, the modern man-of-war is an aggregation of complications, with the principle of division of labour carried to its fullest extent, where system has been pushed so far that it cannot be pushed any farther. The same problems of speed and seaworthiness that confront the makers of merchant ships are in wait also on the designers of the man-of-war of to-day. Not only must she be capable of going anywhere, and getting there quickly regardless of gales and wicked seas, but primarily she is built not for purposes of navigation, but as a movable platform for death-dealing guns. With the special types which circumstances have evolved, both in the navy and the mercantile marine, we shall deal presently; for the moment let us confine our attention to the stages which led up to this modern floating gunnery platform.

CHAPTER XIII

THE PERFECTING OF THE STEAM MAN-OF-WAR

WE have already seen how, side by side, the royal navy and the mercantile marine have, since the introduction of steam, continued to run their race in order to keep well abreast of the progress of science. Sometimes the one has been ahead; sometimes the other has hesitated, only to come on again with a sudden spurt. All sorts of experiments and theories had been tried in regard both to guns and ships. We shall be able now to obtain some idea as to what at its close the nineteenth century had done for the royal navy in actual visible results, as manifested in the ships of that time.

We mentioned at an earlier stage the *Benbow*, a first-class battleship of the "Admiral" class, built in 1888. It was only on this ship, on the *Victoria* which went down after collision with the *Camperdown*, and on the *Sanspareil*, that the 110-ton gun, that huge product of the 'eighties, was mounted. Its subsequent abandonment was due to the realisation that the concentration of fire, delivered end-on, was a defective tactical idea. Its enormous weight was another drawback, and it was only possible to carry two of these, one in either barbette. Whilst the capabilities of destruction which this gun possessed were simply enormous, yet its life was a short one, for the reason that after firing a hundred rounds it was thought to have finished its career, and it is now obsolete. This was succeeded by the 13·5-inch gun, which weighed 67 tons, a considerable saving in weight, so that whereas hitherto only a couple of the 110-ton weapons had been possible on board one ship, it was now possible, since the displacement of the man-of-war had also steadily increased, to mount no less than four of this newer type. But this in turn also had to be discarded, because it could not be fired quickly and soon wore itself to a state of uselessness. During the 'eighties the 12-inch gun had weighed but 45 tons, but this is now practically obsolete also; though the modern 12-inch gun, which weighs about 65 tons, is the standard heavy gun of the British navy.

So quickly does a fine man-of-war make her first sensation by her improvements in design, construction, and armament, and then vanish into obscurity on the appearance of her still further improved successor, that one is tempted too frequently to admire only the present, forgetting all the time that the whole history is one of evolution, and that the handsome ship which we see now represents only one more stage in the romantic history of the naval vessel. The early 'nineties introduced an interesting type of battleship known as the "R" class, of which we may mention the *Royal Sovereign*, the *Repulse*, the *Revenge*, the *Royal Oak*, and so on. In them may be summed up all the beneficial results of the experimental years which had preceded them. The *Royal Sovereign*, for instance, was built of steel, and was so

THE LAUNCH OF THE "DREADNOUGHT"

With the launch of the *Dreadnought* was begun a new era in the history of the warship, and so successful has she shown herself that she has entirely revolutionised the Navies of the world, and made excellent fighting-ships to become practically obsolete.

efficiently armoured with plating and protective decks, that these alone amounted to 4550 tons in weight, apart from that of the hull, engines, guns, and a thousand other entities. A feature of this "R" class was the method of protecting the central parts, a steel deck composed of two thicknesses of plates being screwed on to the top of the armour belt, so as to protect her machinery and magazines from vertical fire. As the power of the quick-firing guns increased in destructiveness, the application of additional armour, so as to go right round the water-line, became essential; and presently the steel of the armour had to be given a surface made by a special process, and so hard as to be less penetrable without any increase in weight, for already the battleship, with her guns and armour, was quite heavy enough in all conscience. The size of these vessels ranged from twelve to fourteen thousand tons, and the speed was from 17 to over 18 knots. Like the contemporary liner, the battleship was by the early 'nineties already a highly complicated organism. Steam had been developed not merely for propelling power, but applied to many auxiliary uses, such as moving the turrets, pumping, hoisting in the boats, and so on. Hydraulic power, too, was used for hoisting up the powder and shell and other objects.

Sails were no longer part of the inventory of the capital ships of the navy, but two masts, made of steel, were retained, as also yards, since they were still useful for signalling purposes. In the naval programme for 1893–94 were included two battleships, the *Majestic* and *Magnificent*, which were to prove most valuable additions to the royal navy, each of these costing £900,000 and possessing a speed of seventeen knots, with a displacement of 14,900 tons. We need not weary the reader with a maze of figures and statistics, but in order to give some idea of her fighting power it is only necessary to add that the *Majestic* carries four of the 12-inch guns of which we spoke just now, twelve 6-inch, and thirty small quick-firing guns. We may explain that the 6-inch gun is the largest of the quick-firing class (though not officially so reckoned), carrying a projectile of 100 lbs. weight, which is the heaviest limit where the projectile has to be lifted by hand and not by machinery. Besides these, the *Majestic* has five discharges for torpedoes, whilst she is protected against the enemy's fire by plate only 9 inches thick, so that, thanks to the introduction of highly improved hard-faced steel armour of small weight and thickness, it is possible to extend protection to a very large part of her hull. It has been found that 6 inches of hardened nickel-steel armour are every bit as effective as 11 inches of the old-fashioned compound armour, and the equivalent of even 14 inches of the still older wrought-iron armour which we discussed at an earlier stage in our story.

In the same programme were included also two first-class cruisers which will be familiar, at least in name, to many of the readers of these pages. These vessels were named the *Powerful* and *Terrible*, each being of 14,200 tons, with a speed of twenty-two knots, equal to that of one of the swiftest liners. The *Powerful* is 500 feet long and draws about 27 feet of water. Of course built of steel, the hull was also covered externally, since she was intended to keep the sea for long periods, with a wood sheathing, and then coppered. She can carry as much as 5000 tons of coal, and has an armoured deck 4 inches thick, the intention of this being that in the event of a shell dropping down on to her, instead of coming at her side, she will still be immune as far as possible. With the functions of the cruiser we shall deal in another chapter, but we may add that it was with the advent of these fine ships that the navy received its handsomest protected cruisers; for the *Blake* and *Blenheim*, built in 1890 and still in the service, are much smaller, and of only 19 knots, whilst the ships of the *Edgar* class and the *Diadem* type are also smaller and slower than the *Powerful* and *Terrible*. It is worth pointing out that in the latter there was used phosphor bronze (which does not corrode) for building certain portions of her; thus her stem, stern, and rudder frames were castings of this metal, all the rest of her hull being of steel. She is flat-bottomed like the modern liner, and has a couple of bilge-keels, whose usefulness we explained in an earlier chapter. The principle of water-tight bulkheads is well illustrated in this ship, for her machinery space is divided up into ten of these compartments, and a longitudinal line extending the entire length of the vessel separates her again into two, whilst between the protective deck and the maindeck just above it the space becomes separated up again into so many more divided compartments. Consequently, in the event of the enemy piercing her hull, she would not be likely to sink straight away, but there would be every possibility of her crew of 800 being saved from drowning. The *Terrible* is interesting, also, as having been fitted with what are technically known as "Belleville" boilers, a type which had been introduced from France, by means of which very considerable pressures of steam could be obtained in the shortest time, and greater steaming capacity was obtainable in proportion to the space occupied, each boiler consisting of a series of continuous tubes which run backwards and forwards over the fire, and incline upwards to a steam-collector. In order to precipitate the solid impurities which would be deposited in the tubes, lime-water is introduced. Like the *City of Paris* and other later liners, the *Terrible* is fitted with twin-screws, each having three blades made out of manganese bronze.

The years 1892 and 1893 were eventful in other ways for the British navy. In the former period the *Howe* had the misfortune to strand on some uncharted rocks while entering Ferrol harbour, and after remaining there for four months, was with great difficulty got off, docked in Ferrol, patched up temporarily, and brought home to Chatham. Her salvage was reckoned at the time one of the finest engineering feats of the nineteenth century. In the same year the *Undaunted*, under the command of Lord Charles Beresford, then a captain, grounded while leaving Alexandria; the *Forth* also ran into a merchant steamer in a fog and seriously injured her ram, thus proving yet again that ramming, even accidentally, could not be effected except with damage to the aggressor herself. But the still more serious instance was that of the *Camperdown* and *Victoria*, which, inasmuch as it emphasises this point still more strongly, and will remain one of the greatest misfortunes that any navy had to suffer in times of peace, must be alluded to here. These two ships, it will be recollected, were with the Mediterranean fleet manœuvring off the Syrian coast on June 23. These were, moreover, the fleet's two flagships. According to the evidence at the court-martial subsequently held, the loss was due to an order given by her admiral, Sir George Tryon, that the two divisions, which were steaming in line, were to turn sixteen points inwards, the leaders (the *Camperdown* and *Victoria*) turning first and the others in succession, the two columns being then six cables (*i.e.* 1200 yards) apart. Although the court collected all the evidence obtainable regarding the closing of the water-tight doors of the *Victoria*, it did not feel justified in expressing an opinion as to the causes of the ship's capsizing. It is interesting to add that naval men were inclined still less to have faith in the ram when they learned how seriously damaged the *Camperdown* was after the accident. Nowadays it is very doubtful if in a modern naval battle the enemy's ships, other than torpedo craft, would be allowed to approach so closely as to be able to execute such a manœuvre as ramming. Before such a possibility could occur, the advancing ship would have been despatched by the firing of torpedoes at her hull, and probably sent to the bottom.

When so many improvements have already gone before that to go one more step forward is immediately to cause the previous results to be obsolete, one cannot but sympathise with the difficulties of those on whose shoulders such serious responsbilities rest. It is a task sufficiently trying to arrange the thousand and one details of a liner's internal economy so that she will come up to the guaranteed speed, but it is still more onerous a task to endeavour to give to a floating heavy battery, with her ponderous guns and weighty armour, all the speed and handiness of the ocean greyhound. The fact that this has been and is being done year by year, improvements being improved upon, the better making way for the best, is at once the pride and consolation of the progressive naval nations. The building of modern navies is no ordinary occupation ; it is the pitting of the cleverest and most inventive brains of nation against nation. Within the nineteenth century the whole aspect and character of the man-of-war has been entirely altered down to the smallest details, and the greater number of these drastic changes were covered by the second half of the nineteenth century, for the influence of the olden times was still curiously strong up to the 'fifties. There are those alive to-day who remember that when they entered the royal navy fifty years ago some of the weapons then employed were very similar to those used at Trafalgar, and so further back to the times of the Armada. The change has been so sudden in its happening, so vast in its extent, that we have scarcely been able to realise it all. Just as, when standing close to a beautiful Gothic cathedral, you cannot possibly contemplate its size or its symmetry until you get away some distance on to the neighbouring hill, so it is with the ship of yesterday. We have been too near her to appreciate this creation at her just estimate, and only a later generation can assess her correctly. But all the inventions of the engineer, all the wonderful triumphs of the shipbuilder, all the originality of the naval architect—everything, in fact, in the making of the warship—is done with one aim, that she may be able to "hit, hit hard, and hit quickly." Types may come and types may become obsolete, but unless the ship is, above all else, an efficient fighting machine, she is not fulfilling the work of her calling.

The closing years of the nineteenth century saw the battleships strengthened by what are known respectively as the *Canopus* class and the *Formidable* class. The principle of grouping ships of war in this manner is that of calling the class usually after the name of the first vessel of that category to be launched. Thus the *Canopus* ships, which included five others built during the years 1897 to 1899, were in many respects similar to the *Majestic* class which preceded them. Each class of ship cost the same amount to build, and though the ships of the former were two thousand tons less in displacement, they were one knot faster, while in length, breadth, and draught they are almost identical. The number of the standard 12-inch guns that we mentioned just now is in each class four, but the *Majestic* carries more quick-firers.

Similarly, the dying years preceding the present century saw the armoured cruisers beginning their important régime, among which the protected cruisers *Powerful* and *Terrible* may be said to have been but the first stage in the evolution of these. The importance which the cruiser class gradually obtained is one of the most interesting features of modern naval development, and we may attribute this to the fact that their mission in the event of war would be to police the high seas and even escort the home-coming merchantmen, without whose cargoes of food supplies we in our island home should very soon be reduced to starvation. The later development of the armoured cruiser as distinct from the protected cruiser has been such that the former approximates very closely to the battleship. With their separate distinctions we shall deal presently in a later chapter; for the present we wish to fix in the reader's mind the fact that though the first armoured cruisers were, in respect both of tonnage and speed, actually inferior to the protected cruisers *Powerful* and *Terrible*, yet the *Cressy*, which was the first of the armoured class to be built in 1899, and her sisters, are far more capable of enduring the enemy's fire. It is not too much to say that the coming of the modern armoured cruiser, of which the present *Indomitable* class is the most recent development, has reduced the value of the *Powerful* and other first-class protected cruisers to something infinitesimal as fighting ships.

Similarly, the second-class cruisers of the same period, though their moderate displacement of four or five thousand tons and their speed of almost twenty knots made them remarkably mobile and enabled them in certain duties, such as scouting, to do good and useful work, yet as fighting ships again they are now of little value, for they are but lightly protected and their heaviest guns are only of the 6-inch type. Another product of the 'nineties, the torpedo-gunboat, has already

From a photo by *Stephen Cribb, Southsea*

H.M.S. "INDOMITABLE"

The *Indomitable* is one of the new type of battleship-cruisers of the British Navy, and in addition to her armour, her eight 12-inch guns, and her sixteen 4-inch guns, she possesses exceptional speed—she has even exceeded the rate of twenty-nine knots per hour, which, considering her other qualities, is remarkable and unique. Notice the space left between the second and third funnels so that the guns may be fired from either side.

begun to be obsolete, not by reason of any defects in construction, but because in the march of time they have ceased to be fighting units. To this class belong the *Dryad* of the year 1893, the *Halcyon*, 1894, and also the *Harrier*. With a length of only 250 feet and a draught of the remarkably small amount of 9 feet, such ships as these, with a displacement of just over a thousand tons and a speed of 18½ knots, were excellent for the purposes for which they were built, viz. inflicting a harassing attack on the enemy by firing from their five tubes death-dealing torpedoes. They were also supplied with a couple of 4·7 guns. But now these ships are relegated to such duties as fisheries-protection work, or as "guide" for torpedo flotillas. The torpedo-gunboats of the 'nineties became too expensive and slow for the work assigned to them, as battleships began to be built with a speed as great as these gunboats, and even greater, and so now their work is assigned to very much faster vessels, the destroyers, whose tonnage is far less.

The reader is well aware that long before the end of the nineteenth century sails had disappeared from the navy. As a broad statement of fact this is true to-day also; but it is worth pointing out, what is very frequently forgotten, that even in this twentieth century the royal navy contains about a dozen, or slightly fewer, small vessels, officially known as sloops, which are auxiliary craft, rigged either as barques or barquentines. (We will define these two rigs presently.) The intention of this revival of a type of ship belonging to about fifty years ago is that these may be able to carry on cruises for a considerable length of time independent of coaling stations. Thus, for instance, where our interests in the Pacific need the presence of a man-of-war this type is particularly suitable, for she can cruise for long periods under canvas alone, whilst yet having auxiliary engines to be set going when necessary. A number of these sloops were brought out at the end of the last century, their size being about a thousand tons. Practically unarmoured, built of steel, sheathed with wood and coppered so as to be able to keep the sea for a long period without needing docking, their heaviest armament consisting of six 4-inch guns, which have wonderful range and powers of penetration when one considers their size. They can be fired fifteen times a minute.

The speed of this sloop type is only 13½ knots under steam at the outside, but, as already hinted, the object of these vessels is not so much celerity as ability to keep the sea and be independent of the shore. It was one of these ships which eight years ago, whilst on the Pacific station, foundered, for she disappeared without leaving any survivors behind to say what happened. The name of the vessel was the *Condor*, and many of my readers will no doubt recollect the reporting of the incident. The probable solution of the mystery is that she was carrying too much canvas at the time and the wind overcame her; and here let us redeem our promise made above to discriminate between the two types of rigs with which this class of special ships has been provided. A barque is a three-masted vessel and carries square-sails on her foremast and mainmast like a full-rigged ship, but is fore-and-aft rigged on her mizzen-mast, without any yards and square-sails thereon. A barquentine, however, is square-rigged only on the foremast, whilst on her main and mizzen masts she is rigged with fore-and-aft sails. Thus these modern sloops—the last was built as recently as 1902—were given (even if only on the foremast) what the deep-sea sailor loves most, plenty of square canvas, which is the ideal shape for this class of work. Some of our finest auxiliary yachts to-day are thus rigged, and have proved over and over again that, with the additional aid of their steam-engines, they make ideal ships for ocean cruising where speed is not so important a factor as it is in the mercantile greyhounds or the fast men-of-war.

Long before the century closed, the employment of electricity, not merely for lighting but for signalling purposes, had been introduced. No sooner does a squadron seem to have come to their anchorage and night closes in than the "winking" of the signalling light begins from one ship to another by means of the well-known Morse code, using dots and dashes of light and darkness. Signalling, although it was certainly known in the men-of-war of the Middle Ages in a crude, elementary form, has now attained a state of high art; but the adoption of wireless telegraphy has enabled fleets to keep in talking distance with each other for many miles out of sight, where, of course, flag or night signals could not possibly be read. Recent naval manœuvres have already indicated unmistakably the part which wireless telegraphy will play in the next sea campaign. It has had at least one curious effect in that it has stopped the abolition of the mast inherited from the old sailing-ship days—the one solitary connection, in fact, which links the days of Nelson with the period which followed one hundred years after. Otherwise, what is there in a modern *Dreadnought* which would enable any one of the sailors that perished at the battle of Trafalgar, if he could come to earth again to-day, to recognise that the latest man-of-war was of the same family, a great-great-granddaughter of the *Victory* whereon he died? If he saw her first from a balloon, he would assuredly not take the *Dreadnought*, brought-up perhaps in Spithead, for a ship capable of doing more knots an hour than probably the *Victory* ever did in twice the time; he would, if he gave any opinion at all, probably describe her as some monstrous fortress, not one single mechanism of which he would be capable of handling. He might go aboard, and he would be horrified to find the historic, time-honoured custom of berthing the crew forward and the officers aft exactly reversed. When he had looked up in wonder at the wireless telegraphy gear and ceased to ask what had become of the sails, although the one or two yards remained in their loneliness with apparently no reason for their existence, he would, except for the fact of the Union-jack being still "worn" forward and the white ensign at the after end, scarcely know which was the ship's bow and which her stern. The tripod mast, the absence of any suspicion of a bowsprit, the dull monotonous hue of the hull instead of the tiers of painted ports, the gigantic funnels, the absence of wood, the prevalence of steel, would all cause him to feel a sojourner in a strange land instead of being at home on one of the battleships of his own mother-country, on one of whose prototypes he had died fighting dutifully. The engine-room would be to him an inexplicable mass of complicated puzzles; the search-lights, the guns, and a thousand other things would worry him almost back again into death; but when that marvel of modern intelligence and smartness, the man-o'-war's-man, acting as his cicerone, informed the visitor, pointing to the ten big 12-inch guns, that a projectile fired from each of these would hole an armoured ship four miles away, but possesses an actual range of something over fourteen miles, the Nelson veteran would no doubt refuse to believe what, after all, would be absolute truth. Patent logs for calculating a ship's rate through the water, deep-sea sounding machines for ascertaining the depth of water below the ship—these would perplex him almost to madness. And then he might look over the ship's cold steel side and see a torpedo-boat destroyer doing her trials along the measured mile in Stokes Bay, and churning up the water at a rate of 33 knots.

After that the old seaman might be left alone to wonder what Nelson, what Collingwood, and the others of his officers would have thought of it all. For the modern sailor is less a seaman than a highly skilled mechanic, who knows his own particular job to perfection, but would have been as out of place and as useless in the battle of Trafalgar as the Nelsonian seaman would be in the way on the *Dreadnought* at the time of an engagement. It would be useless to seek to convince the visitor of the superiority of the turbine engine over its predecessor, for the man would be at a loss to understand the meaning of the terms used. Nor would he be any better off when the subject of torpedoes came up. But at the end he would ask himself, and ask his guide, a question which every member of the community must ask himself whenever one nation threatens another—What, after all, matters? Is it the ship with her armour and ingenious devices; is it the wonderful wireless gear, the turbines, or the guns that really count when the climax comes? It is all these, indeed, but not exclusively these; for in the end, as the Japanese wars with China and then Russia have shown, and every one has always believed would be the case, it is the *personal* element which counts; it is the gun in part, but it is to-day still, as it was in Nelson's time, the man behind the gun who holds the destiny of our peace in his grasp.

Having, then, watched the growth of the ship of war during the last and most interesting stage of her evolution, let us now examine more in detail the composition of a modern navy.

CHAPTER XIV

THE MODERN MAN-OF-WAR

FROM the type of battleship represented by the *Majestic*, *Magnificent*, and their sisters, this class developed during the next years following into a battleship that was fairly light, had a moderate speed, and was armed always with four 12-inch guns, in addition to those of smaller account. Interesting as the study is to all lovers of ships, we have not the space to deal individually with the succeeding classes of battleships which followed. The *Majestics* had been followed by the *Canopus* class, which were in tonnage somewhat smaller but in speed were one knot faster. Then came the *Formidables*, slightly bigger than the *Majestics* but of the same speed — 18 knots — as those bracketed with the *Canopus* battleships. The *Duncan* class of 1901, with a tonnage of 14,000 and a speed of 19 knots, the *King Edward VII.* class, instituted two years later, with the same speed but a tonnage of 16,350, and the *Lord Nelsons* of 1906, differing but little in either tonnage or speed—these all prepared the way for the coming of that new type of ship which has revolutionised the navies of all the world, and has hastened the rapidity of obsolescence beyond any rate previously contemplated.

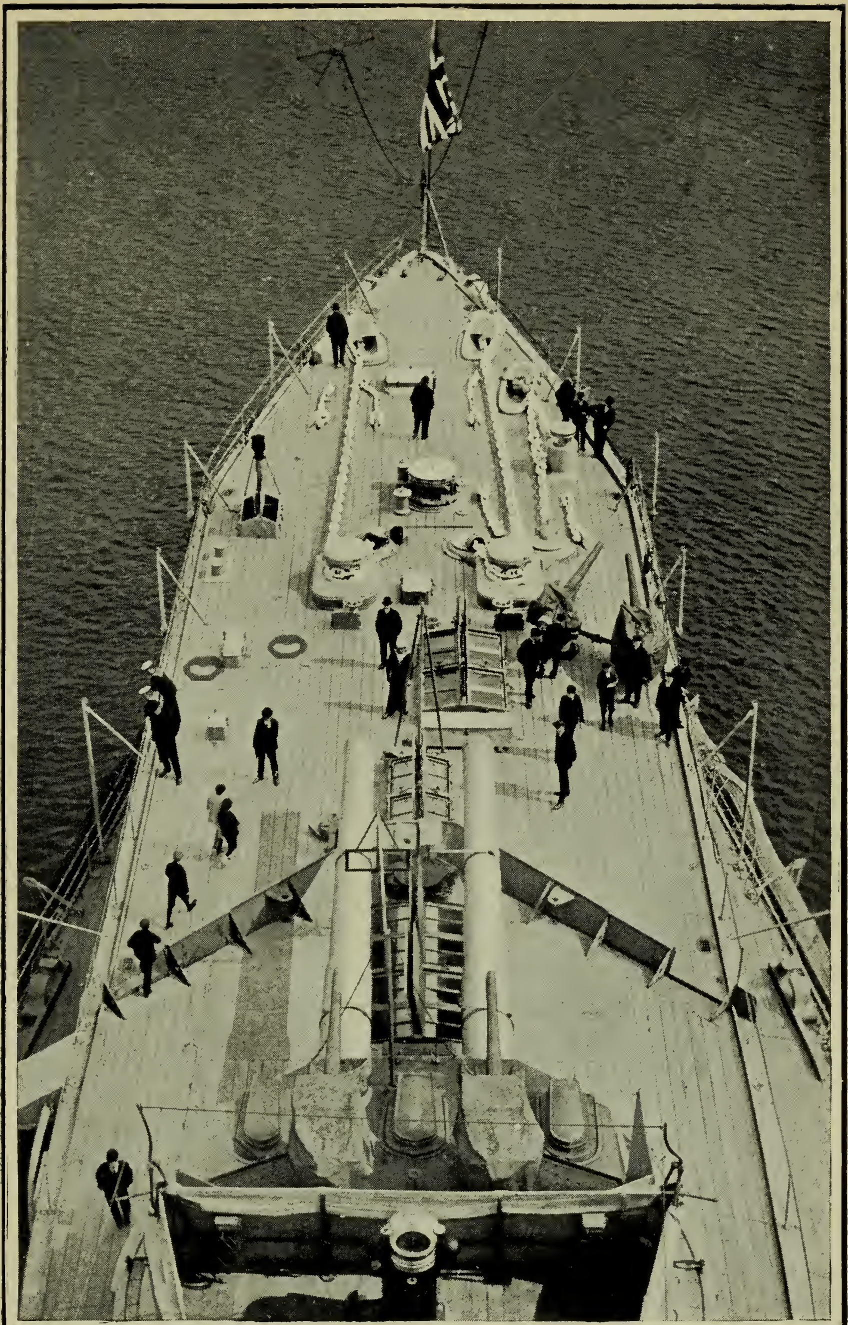
It is, then, with the advent of the *Dreadnought*, one of the most wonderful products of the twentieth century, that the arts of naval warfare have been brought to a pitch of unparalleled terror in the perfection of their death-dealing powers. For the first time in the history of the sea was observed a great steel monster of nearly eighteen thousand tons, heavily armoured and heavily armed, costing a couple of million pounds, with the extraordinary speed for a floating fort of 21 knots. In her we saw the wonderful stage to which the turret-ship principle, combined with a multitude of other and more modern ideas, had developed. The main characteristic of the *Dreadnought* and her successors lies in the thorough-going adoption of the "all-big-gun" theory. In any naval war the issue, it is supposed now, will be decided by the amount of havoc which the guns will work upon the enemy. Torpedoes and mines, deadly enough though they be, are accidents rather than essentials of the modern sea-fight. We have seen the trend of the warship since the introduction of armour and improved guns, and have observed that the last few decades have been one continuous competition between these two contrary entities. The ram came in and went out again; the torpedo, which at first was thought to be able to make the existence of the big ship unendurable, is not the important factor that it once was, and for the following reason. As the power of the gun increased, so did its range; consequently in the next great naval war the opposing battleships will open hostilities when they are several miles apart. Now the torpedo, though an engine of destruction at comparatively close quarters, cannot travel beyond a certain distance, and thus its own limitations, and the extended range of the gun, have caused naval development to concentrate in one particular sphere.

Thus, whereas before the appearance of the *Dreadnought* the heaviest armament of the battleship from the *Majestics* of 1894 to the *Lord Nelson* of 1906 had consisted of four of those 12-inch guns which we dealt with at an earlier stage, now that new type of ship sets the fashion of being supplied with ten instead of a quartette of these weapons, in addition, of course, to her twenty-seven small quick-firers. The coming of the *Dreadnought* has given the standard to all the other naval powers of the civilised world, so that in studying her we are gaining some little insight into the latest type which every nation is copying. The 12-inch gun, too, after no end of discussion and changes, has become recognised as the standard to go by; for, as we saw just now, the old 110-ton gun was found too heavy, while the 12-inch, though anything but light, can be carried well and fired with exceedingly penetrative effect. It will be readily understood that it is not merely the gun which adds up weight, but its ammunition, and its mountings too.

It is indeed difficult to estimate the importance of the gun too highly, and for that reason the whole subject of naval design is based on the principle of rendering the greatest service to these weapons. In Nelson's and earlier times the battleship was a ship first and a weapon afterwards, but to-day she is intended for battle on sea, and everything else is subservient to this purpose. In spite of the important tasks which belong to the cruisers, the torpedo craft, and so on, it is the battleship which really counts, and on her must fall the brunt of the conflict. Unless, therefore, her guns are of such power and her gunners are of such skill that her fire is a fair match for the enemy, little else matters. Strategy and tactics, theories and organisations, avail but little when the main essential is wanting, so that when hostilities begin there is in the naval mind that one guiding principle of hitting first, hitting hard, and keeping on hitting as long as there is an enemy to hit.

Now, hitting has become not merely a remarkably intricate art, but a highly expensive one. Every time the modern 12-inch gun is fired it means a cost of £100. Even at a distance of thirteen miles away its projectile will penetrate eight inches of armour. On the other hand, the *Dreadnought* battleships, to be protected against the enemy's fire, have a belt of Krupp steel, 11 inches thick, this being equal to 20 inches of the old-fashioned compound armour which we discussed some time earlier in our story. The citadel theory, which we also explained, is still well exemplified in the case of the *Dreadnought.* The midship section of the *Dreadnought* is protected with Krupp steel, about 11 inches thick.

To enter here into a discussion of the gunner's art is altogether foreign to our subject, but, as illustrating the development of the ship of war, it will not be out of place to give the reader some idea of the way in which firing from a modern battleship will be carried on in the next sea-fight. When aiming at the object



From a photo by *Stephen Cribb, Southsea*

THE FORE-DECK OF A MODERN "DREADNOUGHT"

This photograph, taken from aloft, shows what the fore-deck of a modern battleship looks like, though when cleared for action the appearance would, of course, be modified. Notice the two 12-inch guns pointing forward, and the powerful cables for the massive anchors.

to be hit, there are various matters to be taken into consideration. Owing, of course, to the law of gravitation, the gun must be aimed higher than the target to be hit. Then allowance must be duly made for the conditions of the air, the rate and direction of the wind; but these may vary very much over the space the projectile has to pass before it reaches its target. Thus, supposing the firing is with a range of 15 miles, the projectile will rise to the terrific height of over 22,000 feet in the air—the height of a very lofty mountain—before it comes down into the hull of the enemy.

Then there is another allowance to be made when the ship firing is under way and steaming anything up to twenty knots or more, for the enemy's vessel will have changed her relative position during the few seconds elapsed since the projectile left the gun, and though this may be only a hundred yards or so it is quite enough to make a miss, and the £100 shot has been expended with no good result. But nowadays naval gunnery has improved to such a state of perfection that after the first shot, which is expected to get near but not hit, the gun is directed to the right or left, lower or higher, according as the first shot has fallen short. Two men are busy at each gun, each looking through a telescope, and each with a wheel for controlling the direction of the gun horizontally and vertically. On shore, when the fort is unmoving, the ability to fire well necessitates the greatest skill; but what shall we say when the fort is a steel ship, which, in spite of her enormous displacement, is never steady for one moment, and in bad weather makes good gunnery one of the hardest tasks that could be wished for? And yet, as affording some idea of the wonderful skill which is possessed by gunners of the British navy, we may mention, not inappropriately, that recently, when firing at a target very considerably smaller than the size of a battleship, at a distance of 8000 yards, or 4½ miles, of the six shots fired four went right through and the other two also ricochetted through.

When next the reader finds himself looking at the *Dreadnought*, he will notice a kind of platform perched high up the mast where its three legs converge. Here is what is known as the fire-control station, whence the ship is, as regards her firing at least, directed during a battle. When opening hostilities the range is found from this platform, and signalled down to the men behind the gun. We need not endeavour to realise the serious position of the fire-control station, which is, in fact, not merely the brain but the eyes of the ship. At a range of several miles it would not be easy to hit this tempting mark, but it is far from probable that damage would not be done to its supports, and in order to diminish the fatal result of such an accident it will be noticed that it is customary now to have the tripod mast, so that if one leg is shot away the other two may support their burden.

Turning our attention now from the battleship to the cruiser, we find the measure of her importance becoming greater and greater, until she has in the case of the *Invincible* class become a much more powerful unit than most of the battleships which preceded the *Dreadnought*.

From a photo by *Stephen Cribb, Southsea*

A "DREADNOUGHT'S" TRIPOD MAST

This shows in greater detail the after-mast of a modern battleship. To the right of the picture will be seen a long line of "Dreadnoughts" and other battleships.

Whereas, as we saw just now, these earlier fighting ships carried nothing heavier than four 12-inch guns, yet the *Indomitable*, *Invincible* and her sisters, though they are cruisers, carry no fewer than eight 12-inch weapons of this kind. The evolution of the first-class cruiser from the time of the *Powerful* and *Terrible*, when they were protected but not armoured, is full of interest. The *Cressy* class, which passed into the navy at the beginning of the new century, were vessels of 12,000 tons, with a speed of 21½ knots, costing £750,000, whilst the *Invincible* cost most of a million pounds more. The heaviest armament of the *Cressys* consisted of a couple of 9·2-inch guns, a type of weapon which has attained great popularity in the British navy, and is found on both battleships and cruisers. Inferior in regard to smashing power as compared with the 12-inch gun, it can be fired more frequently in the minute, and at a range of 3000 yards will carry its shot through the equivalent of 25 inches of wrought iron.

The *Cressy* type of cruiser was succeeded by the County class, which, though several thousand tons smaller, were two knots faster, their armament being fourteen 6-inch guns and thirteen small quick-firers. The *Drake*, the *Good Hope*, the *King Alfred*, and the *Leviathan* followed next, being four-funnelled vessels of 14,100 tons and 23½ knots speed. Armed with two 9·2-inch guns as well as thirty-three guns of small calibre, they are able to get away from many of the battleships afloat, and at the same time to deal them a good deal of damage. After these, in the year 1903, came what are now known as the "New" County class of armoured cruisers, of which the *Hampshire* is familiar to those who spend any part of their season in the neighbourhood of the Isle of Wight. Smaller than the *Drake* class, with the same turn of speed, they were the forerunners, with the *Minotaur* and *Duke of Edinburgh* class intervening, of that newest and most wonderful class of all which has recently astonished the world as the finest, the fastest, and the heaviest armed cruisers in existence. To this class belong the *Indomitable*, the *Invincible*, and others. When the first mentioned made her record trip homeward across the North Atlantic, with the present King George aboard after His Majesty's visit to Canada, this vessel attained the marvellous speed of over 29 knots, beating not merely the record of any warship, cruiser, or battleship alike, but even throwing the marvellous performances of the *Mauretania* and *Lusitania* into the shade. For a man-of-war, with her heavy plated hull and carrying her heavy armament, to have accomplished so wonderful a feat, is an achievement which will long be remembered, and marks a most important stage in the romantic story of the ship. Practically, therefore, the cruiser has evolved from the old sailing frigate to the present state, when she is really nothing less than a powerful battleship but possessing mobility of the very highest order, and in any naval campaign her value would be difficult to reckon too highly. In her, too, the principle of mounting the guns so that there is a minimum of the "dead-sector" defect, which we alluded to earlier, has been carried out with admirable success.

But battleships and cruisers alone do not compose a nation's navy. Although their place is pre-eminent, yet there is important work to be carried out by other and smaller units. A class of small protected second-class cruisers is now being built, and although their size is less than 5000 tons, yet their speed is 26 knots. These vessels, following the example set by the crack ships of the mercantile marine, are fitted with turbine engines. Following out the idea of territorial association, they are being named after important cities of the United Kingdom, the five comprising the *Bristol*, *Newcastle*, *Glasgow*, *Gloucester*, and *Liverpool*. With the *Newcastle* there was at her naming an interesting innovation, for, contrary to practice, she was launched with her four funnels, her boilers, condensers, outermost turbines, auxiliary machinery, boiler-room bulkheads, and protective deck already in place, only two heavy weights —her main turbines—remaining to be lifted on board; and this operation was performed the following day. This established a record, for hitherto no such thing had been done, the custom being to put the engines and so on aboard after the ship has taken the water, so that she may be launched as light as possible.

Another unit which forms an interesting special development of the ship is the scout, whose high speed makes up for her lack of fighting qualities; for she would not be able to endure the battering which even a cruiser could administer to her thinly protected hull. Able to run out to sea and gather important information of the strength and movements of the enemy's fleet, and then flash the news back by wireless telegraphy to the flagship, the scouts have a sphere of great usefulness. Twenty-five knots is their speed, and they are armed with sixteen small quick-firing guns with which to reply to the attack of other fast small craft which the enemy might send out against them. Their draught is only about fourteen feet, so that they are able to negotiate small channels and shallow estuaries. A new class of scout cruisers is being built at the present time, rather bigger than their predecessors, but with the same speed. This is known as the *Boadicea* class. With a displacement of over 3000 tons, they are designed as an improvement on the old type, and will replace the latter as parent-ships to the torpedo-destroyers. These are being fitted with Marconi wireless telegraph gear.

We pass now to that wicked-looking, crafty creature, the torpedo-destroyer, whose mission in life is to send her instrument of death into the enemy's hull quickly yet cautiously, and then dart away as fast as her powerful engines will take her. Her pedigree is worth recalling. At the present stage of development she is practically a large torpedo-boat with a far larger amount of displacement, better sea-going qualities, a powerful engine equipment, and a high rate of speed. She has become, in fact, very much more of the nature of a torpedo ship than the "little, black, tin war-canoe" of the torpedo-boat. But advancing from small size to big, from moderate to enormous speed, the destroyer has become so costly an item in any naval programme that it becomes a serious question as to whether they are worth the money which their construction diverts from the building of battleships and armoured cruisers. Thus the *Swift*, the fastest warship in the world, which was recently launched, is one of the modern destroyer type, and amply illustrates our point. Her cost represents an outlay of no less than £280,500, and when the much more powerful unit, a modern *Dreadnought*, can be completed, with all her engines, armour, and ample armament, for £1,745,000, the problem becomes one of some magnitude. It was in the 'eighties that France and Germany had built up a fairly large class of torpedo-boats. We mentioned some time back that one of the fads through which the navy has passed was the all-importance of the destructive power of the torpedo which the torpedo-boat was to fire, and as a sudden realisation of this fact the British Admiralty created the destroyer, to be superior to the continental torpedo craft in sea-going qualities, in speed, in size, and in fuel-carrying capacity, and to carry small quick-firing guns in addition to the dangerous torpedoes discharged from her side. Originally only a craft of less than two hundred tons displacement, with a top speed of twenty-two knots, the type of the destroyer has continued to develop, until in the case of the *Swift*, just mentioned, and her ten sisters, the displacement is between seven hundred and just below a thousand tons, with the remarkable and unheard-of sea speed of 41 miles per hour. An interesting feature is that this class burns not coal but oil, and can steam at moderate speed for over 1500 miles without "re-oiling," so that in time of war they can keep the sea independently of the shore for a considerable length of time. The Admiralty, as a result of important tests, has made extensive arrangements for purchasing from Scotch companies large supplies of oil-fuel, part of the agreement specifying that the oil shall be stored for delivery as wanted, in big storage tanks, at certain East Coast ports. The oil is obtained in bulk, 20,000 tons being the equivalent of 5,000,000 gallons. The original destroyers had only one 12-pounder and three 6-pounder guns, but each of the newer "Tribal" type mounts three 12-pounders, in addition to the two tubes for firing 18-inch torpedoes.

This *Swift* is the most remarkable ship in any navy of the world, and is fitted with turbines which develop twice as much power as the battleships of the *Formidable* type already noticed. She can travel, in fact, at the rate of 36 knots an hour, which is the equivalent of about 41½ land miles, and this wonderful turn of speed would make her in any naval engagement to-day a most dangerous unit, for from her four 4-inch guns can be fired fifteen projectiles of 25 lbs. each minute, to say nothing of the torpedoes despatched from her tubes. But simultaneously with the improvement in type of ship and armament has gone forward the gunnery of those on board these ships, and a recent Admiralty memorandum states that "their lordships note with great satisfaction the considerable improvement in the results," some of the destroyers having made what are esteemed actually marvellous records, obtaining in one case 15·33 hits out of 16 rounds per minute, the gun used being the 12-pounder.

When the appearance and character of the ship of war are so frequently changing, owing to the restless efforts to obtain perfection in efficiency, it may seem

From a photo by *Stephen Cribb, Southsea*

H.M.S. "SUPERB"

One of the latest battleships of the "Dreadnought" type. Notice the tripod masts, the fire-control stations, the elaborate wireless telegraph gear, and the absence of the old round fighting-top.

only of passing and ephemeral interest that we should discuss the trend of the latest naval types. But the present age sees such marvellous advances made, such comparative equality among naval powers, that it is impossible to have a comprehensive grasp of the modern development of the steam warship, or of its future probable tendencies, without having first gained some insight into the ships that are in being. The *Dreadnought* type, which embodies the principle of the all-big-gun theory, is really the last and most complete extension of that lesson which the little American ship *Monitor* taught during the preceding century. It is a sufficient proof that the turret system of placing the big guns is a thoroughly sound one. The United States, Japanese, French, German, Italian, Austrian, Brazilian, and Argentine Governments have all followed this mammoth battleship type. Foreign navies have introduced such improvements as carrying a powerful quick-firing battery, which the British completed vessels of this type lack. The plea put forward on behalf of the smaller and less costly battleship—of that 14,000-ton *Duncan* type, for instance, which we mentioned above—is not accepted with much enthusiasm among experts. Among other reasons, the smaller class of battleship would be inferior because she cannot be protected to withstand effectively the fire of the heavily armed ship of war, nor in bad weather would she be able to fight her guns with the ease with which the bigger ship could carry on her work. It is probable that before long those battleships which, in any navy, do not belong to the *Dreadnought* type will have to be rebuilt in order to come up to that standard, for the value of the pre-*Dreadnought* ships is diminishing more rapidly than a previous type is usually placed out of fashion. One of the dominant principles of naval strategy is that fleets and squadrons should be composed of ships of similar speed, gun-power, coal endurance, range of fire, and armour-plating resistance; for the strength of a chain, as the old proverb runs, is that of its weakest link—and the speed of a squadron is that of its slowest ship. Similarly, the same rule holds good when applied to the other essential features just enumerated, and the few modern naval battles have proved this far too effectively to admit of any discussion of the subject. This similarity of character is generally referred to in naval language under the category of homogeneity. Now the pre-*Dreadnoughts* are so slow that they would delay the rest of the squadron, as lame ducks set the speed with which a farm-yard pond is traversed. Speed is, in short, together with "smashing power," the great consideration to-day, and will probably continue so to be. In the Atlantic Fleet of the British navy changes have recently been made which have brought about the entire homogeneity of the battleship. At the moment of writing the eighth and latest British *Dreadnought* to pass into the service is the battleship *Vanguard*, and displaces just under 20,000 tons. This ship is also remarkable in that she carries the new improved 12-inch gun, which has a striking power 12 per cent. greater than the previous pattern of this gun, whilst in her, too, may be seen the last chapter of the story of armour development, which the reader has followed step by step in these pages. Instead of the 11-inch thickness possessed by the first *Dreadnought*, this *Vanguard* has it reduced to 9¾ inches, which is thought to be sufficiently effective at modern battle ranges. But the secondary armament for dealing with the harassing presence of torpedo craft is added, consisting of twenty 4-inch guns. On the other hand, although the improved ships of the *Dreadnought* type are in every way superior to their prototype, yet in actual cost they have become cheaper and cheaper to build, so that the *Vanguard* has been constructed with a saving of over £300,000.

With the minor types of naval craft, such as depot ships, hospital, training, survey, repair, tugs, &c., we have no space here to deal, though each, according to her office and ability, fulfils her part in the service by contributing to the aid of the larger and executive vessels. We have been able now to appreciate some of the uses to which the big ships of war will be put in the next naval contest between nations of first-class power, and in watching the development of the fighting ship, whose very creation is avowedly one of war and not of peace, we might be rashly accused of stepping out of romance into terrible reality. But without the ship of war it would be impossible for the merchant vessel to go about her business with any degree of safety; nor, except with that security which a fleet in being affords, would it have been thought worth while to invent and put to practical test those many improvements of which the turbine is but one. Nothing gives the progress of shipbuilding so sudden and powerful a set-back as a war. But when once peace is declared, nothing accelerates the rate of construction so much. The competition between nation and nation, making each type better than the last, and each succeeding ship better than the best, is all in the interests of the ship and in the prevention of war, which brings ruin. To-day more than at any time of the world's history, the ship has shown herself, whether as a man-of-war or as a simple cargo-carrier, to be even less and less dispensable. In the promotion of peace and the advancement of the world's progress she is doing more than the most prophetic seer could ever have foretold, and whatever her subsequent history may be, or whatever modifications may be made in her appearance or means of propulsion, the latter half of the nineteenth and the first decade of the twentieth centuries will remain memorable for the vast and unsuspected changes which so short a space of time brought about.

CHAPTER XV

THE SHIP IN ACTION

WHEN Admiral Togo was awaiting the approach of the Russian fleet before the battle of the Sea of Japan, the first tidings the Japanese admiral received of the oncoming enemy was by means of wireless telegraphy, which his reconnoitring ships, well ahead, used to transmit their tidings. This was the first time such an invention had been used in naval warfare, but its value was proved so conclusively during the British naval manœuvres of 1909 that unless some still more wonderful invention eclipses this in turn, it will be possible in the next naval campaign to keep in touch over oceans of sea. A number of units, for instance, each possessing ability to telegraph for no farther than, say, 200 miles, would, if spread out at that distance apart from each other, be able to keep up a communication of thousands of miles.

Since the revolution which the advent of the steam-propelled, armour-protected ship of war caused in naval tactics, there have been but few opportunities of putting to practical test the theories which during so many years of peace have been fashioning the construction and disposition of our fleets. We have already alluded during the course of our story to the Lissa campaign of the year 1866 between Italy and Austria-Hungary, to the naval war between Chili and Peru of 1879-81, as well as the American Civil War, and from these we have taken instances to show the use of certain ideas and the employment of certain types of ships in fulfilling the especial duties for which they were designed. We might go on and in like manner watch the lessons to be learned from the Chilian revolutionary war of 1891 and the attempted Brazilian revolution of 1893-94, of the memorable Spanish-American War of 1895 and the Russo-Japanese War of 1904. Our space, however, is limited, and we shall confine ourselves to the most momentous naval war of them all and consider only the last mentioned, which, because of its greater modernity, is of far greater interest, since the conditions under which it was waged approximate to those which may be expected in the next war on the sea.

The intention which is uppermost in the mind of an admiral on the eve of battle is so to arrange the ships under his command that he may be able to pour into the enemy the greatest amount of fire whilst receiving in return a minimum of damage. In order to put this intention into practice, it is not exclusively a question of possessing the largest aggregate of big guns, but of disposing his ships in such a manner that these guns may be given the chance of doing their uttermost. In a word, the ships must be so manœuvred that the gun-fire may be concentrated. The probable formation of the British navy in time of war would be for the squadron of battleships to

From a photo by *Stephen Cribb, Southsea*

THE TORPEDO-BOAT DESTROYER

The torpedo-boat destroyer has had a curious history, as will be seen from the accompanying pages. Wicked-looking, speedy, and dangerous to encounter, she has become a very expensive creature to build.

steam in "single line ahead," that is, practically, single file, the senior flagship ahead and the other battleships following astern at intervals of two cables (or 400 yards). On either side of this line would steam the cruisers, thrown out a great distance, and keeping in touch by means of wireless telegraphy. But as a distinguished Norwegian admiral has recently pointed out, the difficulty of fighting in a long single line is very great, when the line consists of a large number of vessels. At the battle of Trafalgar the British fleet was arranged in two "grand divisions," and to the commander of each were given instructions to have the entire direction of his line, to make the attack on the enemy, and to follow up the blow until they were captured or destroyed. This arranging of the fleet in two divisions was tried also in the Russo-Japanese War, but to-day, with battleships possessing a speed of twenty knots, when movements and phases happen quickly, matters are more complicated than formerly.

At the battle of the Sea of Japan the Russians advanced in two columns, the special service craft being in the rear. Then they bore down on the Japanese in a diagonal direction, the armoured cruiser squadron following in the rear of the main squadron, and the whole thus forming now one single column line ahead. Afterwards the battle developed a more desultory nature, and here the Japanese ships availed themselves of the advantages which the arrangement of their guns permitted. Thus, after placing their ships so as to pour a deadly broadside into the Russian ships, they steamed round the enemy's stern and fired at her other side, thus bringing into action the greatest concentration of the most powerful guns.

At the battle of Lissa the Austrian fleet, on July 20, 1866, was formed into three divisions; the order of each division was unique, and this attacking formation is not likely to be repeated, although the Austrians were victorious. It is not easy exactly to describe the order, but it may be summed up by saying that each division was, in technical language, "disposed quarterly to port and starboard," or in the formation of a V-shaped wedge, the senior officer's ship being at the centre or point of the wedge, the second division following the first, and the third the second. But in this battle, as in the battle of the Sea of Japan, mist and fog, coming and going at intervals, hampered tactics in a most annoying manner. In the former, as soon as the Austrian scouts had reported "Six steamers in sight," and from the flagship almost simultaneously smoke had been discerned to the south-east, immediately a squall of rain shut down any further observation at a most critical juncture, and the weather did not clear again for two hours. In the more recent battle, after the Japanese had concentrated heavy fire upon the Russians so that several of the latter's ships burst into flames and were compelled to leave the firing line, a fog came down and enveloped the fleet, insomuch that the Japs ceased firing at the enemy for a time. It is thus that Nature, by suddenly obliterating the range of vision, can reduce the best laid schemes of strategy and gunnery to utter uselessness.

In the event of a naval battle being fought, for instance, in the North Sea, it is more than likely that the

A TORPEDO ATTACKING A SHIP

This interesting picture shows how a torpedo, after it has been fired from a torpedo-boat or other craft, makes for the enemy's ship. The latter endeavours to make this dangerous engine inoperative by the protection of the torpedo-net, made of steel wire and held out by steel booms. The figures marked on the sketch of the torpedo refer—reading them in their numerical order—to the propelling twin screws, vertical rudder, horizontal rudder, bevel-gear, shaft, buoyancy chamber, starting-gear, starting-pin, engine chamber, balance chamber, gyroscope, weight on rudder for controlling distance below surface, compressed-air chamber, war-service head, charge of gun-cotton, fulminate of mercury, striker, safety-pin, fan.

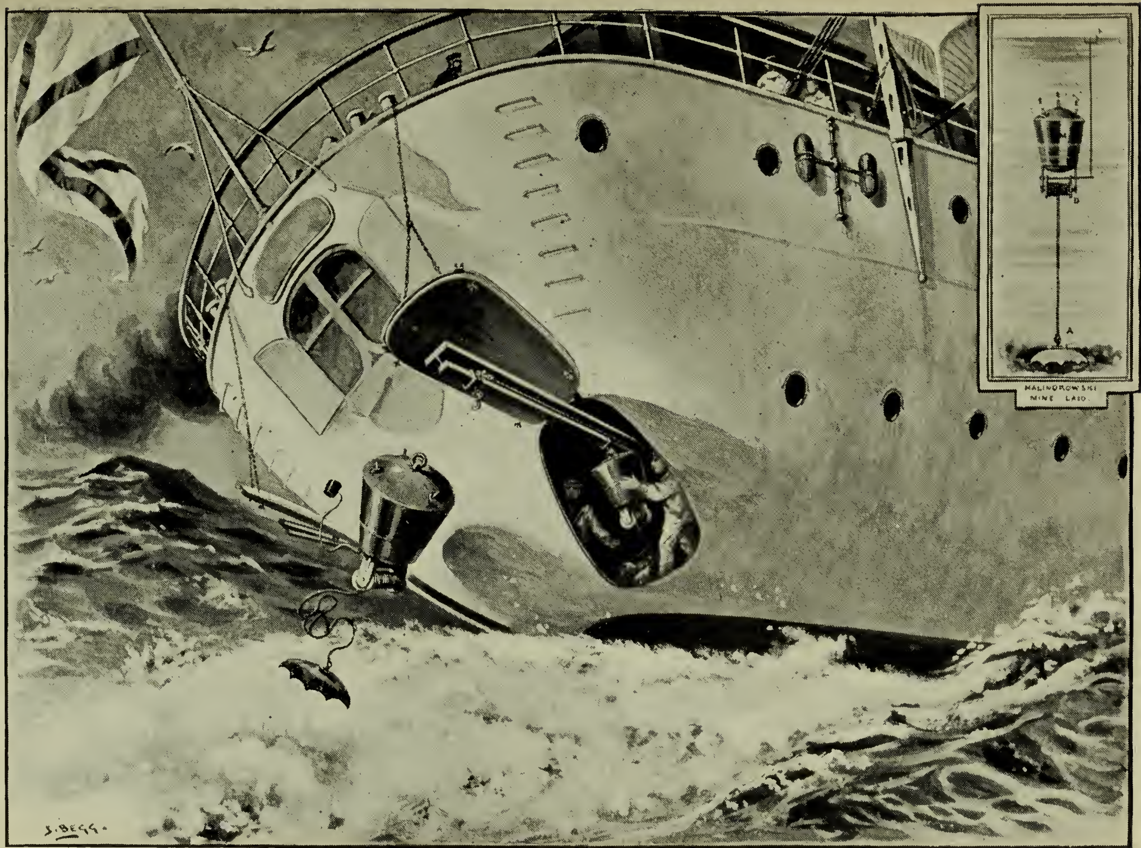
fighting might have to be carried on at much shorter distances than the full range of those monster guns. When fog and mist and haze are such prevalent conditions as they happen to be in this particular ocean, there is no telling what formation might have to be made for attacking the enemy. Whilst the enemy might be thought to be some miles away, he might be suddenly descried emerging out of the evening fog settling down after a warm day, or coming out of the morning haze and pointing to any angle of the opposing fleet—right ahead, abeam, astern, or even on a parallel course. It is for this reason that two fleets might remain in close proximity for some time without being aware of each other. In a few minutes the fog might lift and the firing begin at comparatively short distance. As an instance showing once more what mischief a fog can do in shielding an enemy, we may give the case which was recently adduced by a distinguished British admiral, who related that a short time ago an admiral was told to consider himself in command of the enemy's squadron escorting an imaginary force of 70,000 men across the North Sea to Scotland. Owing to the prevalence of a fog, which kindly obliged at a most suitable time, and continued practically all the way during the passage, the "enemy" was able to reach his allotted port without meeting one single British ship.

One of the lessons to be obtained from the Russo-Japanese War was the amount of harm which the torpedo was able to inflict. After the battleships had engaged the Russians during the day, inflicting terrible injury on the enemy, Togo withdrew and left his torpedo-boats and destroyers to carry on the work during the night. In the darkness they fulfilled their mission so well that, in spite of the Russian search-lights trained on these stealthy little craft, the Russian ships were thrown into a condition of entire confusion. Three of them were torpedoed within a short space of time and rendered unmanageable, and—here is an interesting point as showing the necessity for anti-torpedo armament in addition to the big guns—so close did the Japanese torpedo craft advance to the hulls of their enemies' ships, that the Russian guns could not be depressed sufficiently to aim at the harassing hornets. But there is probably no kind of naval work which demands such caution combined with dash as carrying on "destroyer tactics" at night, and it is not surprising that besides three of the torpedo-boats which were sunk by the enemy's shells, the Japanese craft suffered much injury by colliding with each other.

And here let us say something about the torpedo and the torpedo-boat, since we have already spoken of the destroyer. The torpedo itself is practically a small, cigar-shaped automobile boat, which is driven by an engine and propeller, the motive power being compressed air, and the torpedo can be aimed at any part of the enemy's hull, without being deflected during transit. Supplied with an explosive charge of gun-cotton, it is fired from its tube on board its mother-ship, and on coming in contact with an obstacle explodes. Big ships discharge these through submerged tubes, whilst a smaller type is discharged from torpedo and destroyer craft from a tube placed on deck, which can be swung round and fired on either side. At one time the battleships and cruisers were able to fire them from above the water-line also, but now they are discharged from what are known as "flats"—special compartments below the water-line—lest an enemy's shell should strike the torpedo ere it left the ship and so spread destruction on board.

Nowadays the torpedo is, though somewhat complicated, a thoroughly reliable little creature; but the following incident will show that this was not always the case. During the war between Chili and Peru there was a moment of the greatest anxiety when the Peruvians endeavoured to torpedo the Chilian corvette *Abtao.* The Peruvian monitor-ship *Huascar* had called at Iquiqui and taken on board a couple of "lay" torpedoes, together with a man who understood their working. Off Antofagasta they found the *Abtao* at anchor, and it was resolved to destroy her forthwith. The *Huascar* therefore approached within about 200 yards of her victim, when one of the torpedoes was launched from the deck, and had only proceeded a little distance on its journey between the two ships when it suddenly began to turn to port and return to the *Huascar.* This type was driven by compressed carbonic gas, but steered by electricity through a cable which unwound itself as the cigar-shaped weapon progressed through the water. When it was seen to be heading for the *Huascar,* efforts were in vain made to stop it by means of the cable, but something had gone wrong and the best that could be done from the ship was to minimise the speed. Therefore, with great courage and enterprise, Lieutenant Diez Canseco jumped overboard and succeeded in deviating the torpedo from its course, and thus saved the *Huascar* and her crew. It is amusing to find that the Peruvian admiral was so disgusted with these treacherous weapons that when he returned to Iquiqui he forthwith landed both of them and buried them in the local cemetery. Had the modern Whitehead torpedo been then in use, there can be little doubt but that the *Huascar* would have blown the *Abtao* to pieces, or at least holed and sunk her. The present effective range of the torpedo is 2000 yards, though it is said that by means of a fresh improvement this distance can now be increased, and recently continental experimenters have endeavoured to direct them (after having left the ship) by means of wireless telegraphy. Now and again one hears of one of these weapons getting lost during practice and being picked up by fishermen. They are costly instruments and are valued at £500.

It was, then, for the purposes of carrying and firing these new creatures of destruction that the torpedo-boats were built. They were to be of great speed, light of hull, to rush forth and discharge their torpedo, and then withdraw as fast as they could. The early types of these torpedo-boats were of limited capacity, and could carry but little fuel. Later on they were given quick-firing guns as well as the torpedo-tube, and by now they are of about 300 tons, with a speed of about 25 knots and more. Their hull is necessarily made of such thin steel as to be unable to withstand any fire from the enemy, and the slightest collision with any hard substance injures them at once. Extremely narrow and long, they are not particularly weatherly, and in a sea-way



A Russian Mine-laying Ship

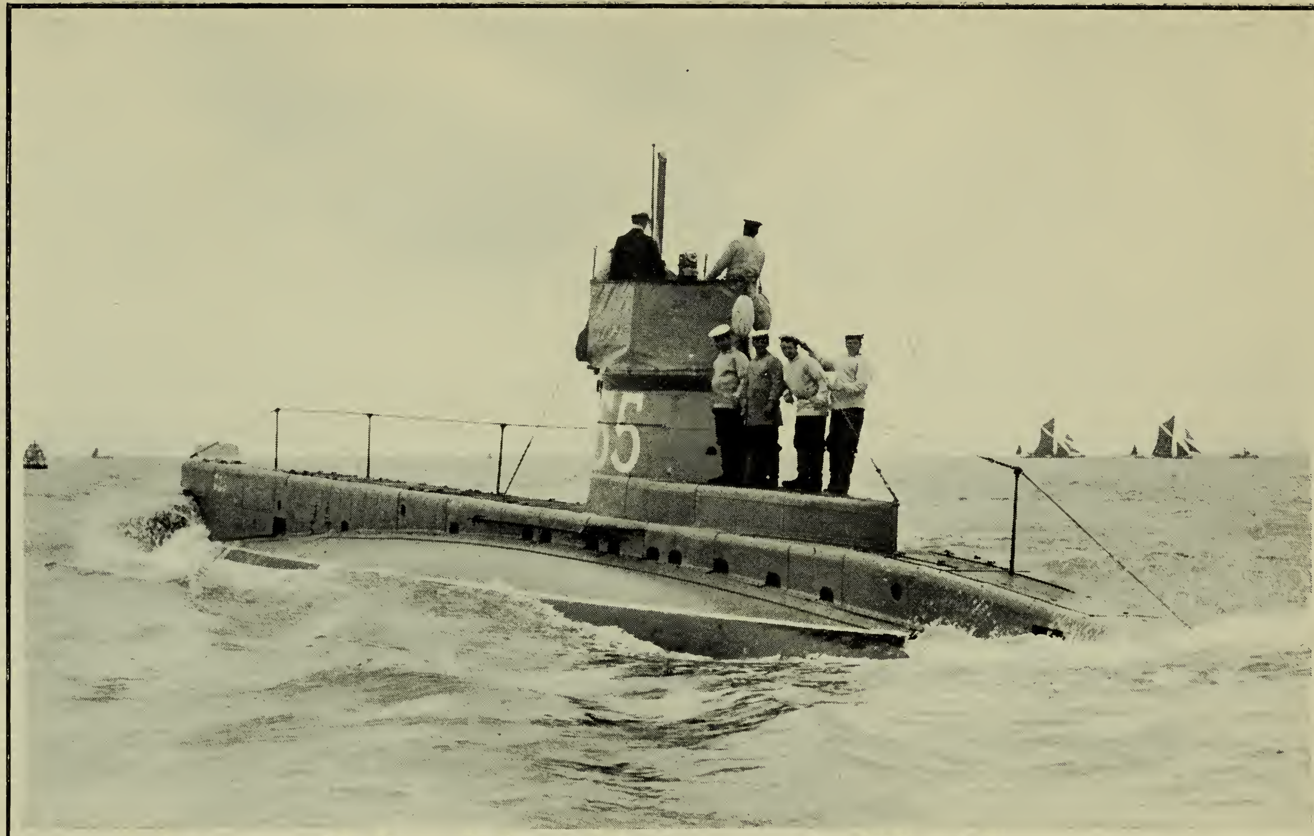
This shows the ill-fated *Yenesei* depositing mines during the Russo-Japanese War. As will be easily seen, the method employed consisted of running the mine out-board from the stern. It was then released and allowed to drop in the water, where it anchored itself by means of its mushroom anchor. The smaller illustration shows the mine laid below the surface, but as soon as a ship touched its upper portion it would explode. The *Yenesei* unfortunately was destroyed by one of her own mines.

very wet and lively. The forward end has a long turtle-deck, forming the roof of the men's quarters, which, considering the size of the ship, are particularly roomy. The engines are amidships, and the two officers' quarters right aft.

Another lesson which the Japanese War afforded was the terrible amount of danger to be feared from floating mines, whose known presence might be able to deter in the future the approach of a squadron of battleships across a certain space of water. In order to possess suitable ships for clearing the sea of these mines, the Admiralty have recently purchased a number of high-class steam trawlers which, by means of their trawling gear, will be able to remove such objects of danger and clear the channel for the approach of the fleet. Men-of-war have also been lately fitted with suitable gear for this work, in addition to the trawlers. It is generally supposed that the known presence of mines, and the realisation that they may be suddenly met with and the ship blown to pieces, would act as a most powerful deterrent, and the reader may imagine for himself the terrible feelings of suspense on the part of the officers in charge of the ship, impressed with the possibility of its encountering annihilation at any moment.

From the torpedo and its allotted craft, the naval trawler and the mine, let us turn now to that other modern engine of destruction, the submarine. The most recent example of her class is much more of the nature of a ship than her predecessors. This is the "D" type, and is an improvement on the "C" class, of which the general reader retains an unhappy memory when he recollects the tragic accident which occurred to one of these craft, the *C11*, in the North Sea, by which the little ship and her crew were sent to the bottom, and in spite of continued efforts were never raised. Just as France had been ahead of us in the realisation of the war value of the torpedo-boat, so it was with the submarine. In 1900 we possessed not one of these, and even in 1902–3 we had barely a dozen whilst France had nearly forty, but now we number more nearly a hundred in the British navy. The United States had already learned to appreciate these novel engines of war, and the first submarines to be constructed in Great Britain were five of the Holland type, being thus called after the name of the American inventor. This class represented quite a small ship, with only a displacement of 122 tons, and a speed on the surface of the water of nine knots, but only seven when the vessel was submerged. The "D" group now is of quite a considerable size, each vessel of this class having a displacement of 600 tons, with a speed on the water of sixteen knots, but ten knots when travelling below the surface. Although the submarine is not supposed to be particularly seaworthy, yet flotillas of these have recently shown, by their lengthy coasting cruises from the English Channel to Scotland, that their ability has been underrated. There have been several terrible accidents to the submarine, both in this country and abroad, but she is too useful a weapon to be omitted from the service. Practically she is a torpedo-boat, but of a very special kind, and her method of procedure consists of discharging her torpedo, which can be controlled for some distance after it has left the submarine. On coming into contact with the enemy's hull the torpedo explodes and wreaks its awful damage, and the little submarine herself has to retreat as well as she may, either below the water or, returning to the surface again, along it. We can picture her after she has sighted her foe by means of her "periscope," which is a tall, thin, mast-like structure whose top appears just above the water. The reader may perhaps at some time have made use of the old-fashioned "camera-obscura," which reflects an image downward, so that what is going on outside passes before the observer's eyes. In the same manner this periscope is fitted with a number of lenses which reflect whatever is visible above water so as to be seen by the steersman. When the submarine wishes to dive, she fills her ballast tanks with water until she is like a rock that is just covered at high water. Next the engines which are employed only for navigating along the surface are stopped, and these for use below the water are set going. Every reader knows what a ship's rudder looks like, and that it moves horizontally, from side to side, so altering the direction of the vessel. Now imagine a rudder which moves not horizontally but up and down, instead of from side to side, and you get the action of the "deflecting" rudder with which the submarine is fitted. It will be immediately realised that this diving vessel will want both kinds—the one for altering her course from starboard to port, and the other for causing her to descend or ascend the waters. Therefore when the engines for use below have been set going, and the "deflecting" rudder is inclined, the little vessel is bound to descend gradually, not straight down, but at an angle. But as soon as the engine is stopped the depressing influence of the helm is neutralised, and the submarine ascends to the surface again.

It is because the submarine has to carry two separate sets of engines that she is more heavily weighted than ought to be necessary. For cruising along the surface, motor-driven engines are set to work, but when the ship descends below there is only a comparatively small air-supply, and this is very precious. If the petrol motor engine were used now it would speedily consume what little air there is, so that another engine, driven by electricity from storage batteries, is employed. When you see the submarine under way you regard a curious sort of creature resembling something between a whale and a torpedo, across which the waves break as if over a ridge of shore projecting out into the sea. Tied up in harbour she looks just as little habitable, being practically nothing more than a cigar-shaped tank, with a curious bridge erection standing up amidships. Taking her as a whole the submarine is not a thing of beauty, but of discomfort and danger. To the enemy suspecting the presence of mines and a few submarines lurking below the surface, suspense and anxiety would come with cumulative effect. On the other hand, whilst the enemy could scarcely dare to move until he was assured of the absence of these objects, yet the anxiety on board the submarines would be but little less. Confined to quarters of the most limited and least comfortable order, with no power of defence, and the possibility of being instantly destroyed on returning to the surface, with the further possibility



From a photo by *Stephen Cribb, Southsea*

A BRITISH SUBMARINE

This shows one of the "C" class. It will be remembered that the "C 11" had a tragic end to her career in the North Sea.

of something going wrong in her complicated gear, the crew who volunteer for such work go literally with their lives in their hands. We could say more of this exceptional type of ship—possibly the most extraordinary of any that we have yet discussed—but we must pass on. To-day, with the coming of the "D" class as introduced in the British navy, we are approaching the time when a sufficient margin is left for safety, so far as is practicable. This is a long stride from the early attempts which were made in regard to this type of craft. Thus as far back as 1878 an interesting submarine boat was experimented with in the Liverpool Docks, but this was driven by manual power. Had the motor been then already invented, it is possible that the submarine might have come earlier into our navies. Following on this a year later, another vessel was built of steel, and could be completely closed, being driven by a single propeller, with a pair of rudders amidships for deflecting, but the usual rudder at the stern for steering from side to side. Her crew consisted solely of three men, and her name was the *Resurgam*; but she belied her title, for she was lost at sea and never came up again. The method adopted in this craft for propulsion was interesting. The engine received steam from an internally fired boiler. When cruising below the surface of the sea the furnace was closed, the heat in the boiler water supplying the steam required, and thus she could steam for twelve miles when submerged. For the support of the crew whilst thus confined a special air-purifying device was fitted. Submarines have still to make their debut in naval warfare, and not till then is it possible to decide whether, in return for their costliness and the risks which are run by their crew, they are really worth all that they have involved.

We cannot omit here to refer to another of the important lessons which the Russo-Japanese War bequeathed to the great naval powers, and one which has since been made use of in no small measure. We have already touched lightly on the subject of "fire-control," as the term is in naval parlance. Formerly gun-fire in time of battle was directed by means of speaking-tubes from the conning-tower, where the captain and his advisers are to a certain extent protected in an armoured little fort. From here the pipes led down to the men behind the gun in the turrets, who thus received the instructions as to the nature of the fire which the enemy was to be entertained with. One of the lessons to be learned from the war between Chili and Peru was that the commanding officer should be located in a safe place, and it was found that the worst possible place for him was near the base of the smoke-stack, which was the best vertical target on the whole ship. The conning-tower was therefore to come of a necessity. But a ship is a huge mass of separate entities, and with so many guns aboard it became increasingly evident, as the Japanese War confirmed, that a gunnery officer should be told off for the purpose of controlling and directing the firing from a higher altitude. The fighting-top is now falling into desuetude, and the fire-control station is regarded as a position of the greatest importance. From his superior height the gunnery officer is able to tell how well or how badly

An American Ingenious Mast

This shows the after-mast of the *Idaho* of the United States Navy. This curious shape, called variously the "waste-paper basket" or "haystack" type, was designed with the intention of avoiding entire demolition if the enemy's shells should hit it. But it has been found that the mast possesses too flexible a character to be of sufficient use in range-finding.

the firing is going on from his ship, and by means of electric wires and a switchboard he is able to keep in communication with all the big guns on board. The next time the reader passes a battleship, if he will look up at the little platform on the mast he will be able to imagine for himself what are likely to be the feelings of the man, perched between heaven and sea, directing death into a barely visible enemy away in the enveloping haze, whilst around him heavy projectiles are whizzing and armour is being battered, every man doing his work, yet hidden from sight. We hinted on an earlier page at the possibility of one of the triple masts being shot away, and even the whole structure coming down, together with the fire-control platform. For some time the United States authorities have been trying instead of the steel masts, even in tripod form, a kind of iron lattice-work, somewhat resembling a miniature Eiffel Tower. The theory is that the shells, even if they penetrated this structure, would not utterly wreck it, and so the fire-control platform would remain aloft. But experience has lately shown that this structure, ingenious though it is, sways too much because of its flexible character, and that thus the ranges, as reckoned from the fire-control station here, are not sufficiently accurate. Perhaps when the steam-engine gives way in time before the perfected oil motor it will be possible to abolish the funnels, and some other ingenious method of controlling the guns will be brought in; but the time is not yet.

CHAPTER XVI

THE MERCANTILE MARINE, AND YACHTING

WE have been able to obtain some idea of the nature of a nation's fighting ships; let us now see what is the kind of vessel in which the valuable cargoes are carried from port to port, from country to country. Already we have considered the liner, that marvel of engineering skill, and have traced her pedigree; but not all steam merchant vessels are liners, any more than all the ships of the mercantile marine are exclusively steam-propelled. Let us look into the matter.

Practically all the coal-carrying trade round the British coast is carried on to-day in the steam collier, but during the eighteenth century this was done by sailing vessels brig-rigged, that is, square-rigged (with such shaped sails and yards) at both of her two masts, but carrying a fore-and-aft sail, called a trysail, on her mainmast. Even until late in the nineteenth century this type persisted, but the progress of steam soon showed that the older vessel was doomed. Some of the finest of these collier brigs were those which came out of Whitby on the Yorkshire coast, their size being usually somewhere about two hundred tons. When it was found that steamships could carry the coal from the north to the southern ports not merely with greater despatch, but cheaply and as regularly as the weeks went by, there was but little encouragement for the old brig to remain. Suffering from neglect, manned by brave but poorly paid sailor-men, many of them have ended their leaky days in the North Sea, the survivors being perhaps taken off by a passing trawler or Dutchman, or the crew perishing altogether in the fury of a winter's gale. Nowadays the steam collier has gradually evolved into a fine, able, ocean-going ship of several thousand tons, with a speed which not many years ago the Atlantic liner could not afford to despise.

To any one familiar with the lower Thames no kind of craft is more familiar than the sailing barge, which, tracing its descent from the Dutch of the seventeenth century, is now the characteristic type of the Thames and Medway cargo-carrier that is not steam-propelled. The barge belongs to a somewhat large family, and varies from the small "stumpy" to the much larger sea-going type which one sometimes encounters as far down the English Channel as Devonshire. With a crew never exceeding three in number, and more often consisting of just a man and a boy, these craft carry a considerable share of the coasting trade, though chiefly to the ports contiguous to the Port of London; and the advantage of their flat bottom is that they can enter shallow creeks, where the tide eventually dries out; and take the ground without risk of injury to the ship's hull. With mast and sail lowered, they can creep up a narrow gut of a canal and lie alongside some factory wharf for loading or discharging their cargo, and then proceed round to Harwich or other North Sea port, or else go beating to windward down Channel against the usual south-west wind, past Beachy Head and Selsey Bill, to one of the Hampshire ports, or, further still, round Portland Bill and the Start to Plymouth.

Another type of sailing merchantman which is still alive and very much in evidence round our coasts is the topsail schooner. The peculiarity of her rig consists in the addition to the fore-and-aft schooner rig of two square-sails and yards placed high up on her foremast, and called respectively the foretop-sail and foretop-gallant-sail. There are very few harbours of this country in which the reader will not be able to see one of these black, tar-hulled vessels loading or unloading. She is ever actively engaged in the coasting trade along our shores, and, for her own particular calling, is admirably rigged; for the square-sail, as already mentioned, is very suitable for running before the wind for any length of time, whilst its defects lie in its lack of handiness. A compromise is therefore made, retaining some of the characteristics of the full-rigged sailing ship as well as preserving the main distinctions of the fore-and-aft schooner. Running up Channel, say, from Cornwall to the London river, before a westerly wind, the advantages of the square-sail are particularly noticeable, while the other rig with which she is supplied makes her sufficiently handy for entering harbours and narrow channels. There are few sights more pleasing than to watch these picturesque ships turning to windward across some wide bay, but owing to the retention of this square-sail they are not able to go so close to the wind. Her rival is perhaps the little coasting steamer which, more business-looking if only moderately picturesque, is able to carry a greater amount of cargo in her hold, and to do so at such a price as to leave the poor sailing ship but little to live on. A new method of compromise has, however, lately arisen, owing to the invention of the internal-combustion engine. Some of these schooners are being fitted with these motors, and are able to stem the tide of bad luck. We may take for instance the case of the top-sail schooner *North Barrule*, a vessel of a hundred tons, which trades between Kippford, N.B., and Liverpool. In olden times she used to be delayed in port by lack of wind for as long as six to eight weeks, and all the time no money was being earned and the expenses of the crew continued. There were, too, times when the tide did not serve, and winds were contrary; but now she is installed with an engine giving her a speed of five knots per hour even when loaded fully, and she can leave harbour independent of winds or tide, sometimes even giving a sister sailing ship a friendly tow. No doubt the coming years will witness the conversion of many of our poorly paid sailing traders into auxiliary ships, for the cost of placing a motor on board is not long in being repaid by the saving of time and of the charges for employing a steam-tug for certain harbour entrances. We might take the case of Dartmouth as an example. Here the harbour mouth is narrow, the tides are strong, the shore is strewn with dangerous rocks, and the wind is so fickle and fluky that one minute it is a calm, and the next moment it rushes down with such force as to make the handling of the ship exceedingly anxious work. The use of a tug, therefore, becomes imperative; but when the auxiliary ship comes along she can lower away her sails on approaching the entrance, and then, getting her motor engine to work, she can enter with confidence and without dependence on local help, thus saving not merely expense but valuable time also. It is thus only that the sailing ship has any prospect of holding her own as a cargo-carrier in the coasting trade.

Kipling has spoken of the liner as a "lady": so she is, in more ways than one. But she has honourable sisters, which ply their calling with many an anxiety both as to finance and weather. The expression "steam tramp," as applied to a certain kind of steamship, is not unknown to the reader, an appreciation which only needs the explanation that whereas the liner is one of a series of ships carrying out the same voyage out and home with the utmost regularity, the tramp is but a wanderer across the face of the sea, with no fixed route, but picking up a cargo here, taking it to some out-of-the-way port, and then looking about for another odd job of the same nature. With her nine-knot speed she has often been laughed to scorn by the sailing men, as she creeps along, grinding out the revolutions of her propeller with distress, and "playing at submarines" whenever a beam sea comes driving along. Badly built, equally badly paid, and almost as leaky as the proverbial lobster-pot, she was for a time a disgrace to merchant shipping, and when she disappeared in a storm her unprincipled owners were more than compensated by the insurance money. But to-day, though there is still room enough for better things, many of the past abuses are disappearing. Nowadays competition is so keen, and the advance in shipbuilding has gone so far, that the cargo-carrier is second only to the liner in excellence of her construction. Special types are designed and built for special trades. There are those suited for carrying oil in bulk across the Atlantic; others are confined to the carrying of cotton and wool; others, again, bring over those vast supplies of cattle from the continent of America, landing their cargoes in Liverpool, Antwerp, or London. The tendency, in spite of the fact that bad trade (which immediately reflects its condition on shipping and shipbuilding) now and again stops progress, is to build and launch ships that are thoroughly sound and seaworthy and admirably fitted for the work contemplated. The old ways of seamanship are no doubt disappearing fast, and the few hands which a steam cargo ship needs to carry, in comparison with those which were numbered in the old clipper days, are, like the men in the navy, more mechanics than seamen. It is the engineer and the stoker who have taken the place of the real sailor-man. On the bridge the master has had to adapt himself to the new conditions, to the latest form of seamanship. Heaving-to during a gale, for instance, with the propeller going just dead slow, is not the same kind of sailor work which heaving-to in a full-rigged ship implies. But the principle of "other days, other ways" is true, and the ability of the modern captain is far more scientific, even if his troubles and complex duties are in no degree fewer than in the olden times.

Among the smaller fry, the early Victorian tug has developed into something by no means worthy of disrespect. Possessing engines of very great horse-power, with strong steel hulls and considerable strength, they are capable of any kind of work that could be asked of them, from towing a small sailing ship out of harbour to towing a massive floating-dock across the Atlantic. Often one meets with one of these able tugs taking a big four-masted sailing ship down the English Channel until she is well clear of the land and begins her long voyage across to the American continent. The paddle has again given way to the screw, wood to steel, and the moderate-speed engines to those of high power and entire reliability, essentials that cannot be dispensed with when the tug is called upon to carry out such trying tasks. As an old sailor previously employed on powerful tugs remarked to the writer some time ago, it isn't in fair weather, when the sun shines and the waves are still, that the tug is busily employed, but it is when the equinoctial gales are blowing and big ships are in distress that the tug is wanted for rescue and salvage. Perhaps a liner, full of valuable cargo, has stranded on the edge of the Goodwins, or a full-rigged ship has got "picked up" by one of the banks at the entrance to the Thames estuary, when the sea breaks in its full fury over her hull. It is then that the tug steams bravely forth, and the worse the weather the more is she likely to be needed.

But there is another type of craft, of which one hears but little, though it is familiar to those whose work is on the face of the waters. She carries no cargo except her own men, she has to face all sorts of weather, and even the biggest liner cannot get on without her. We refer to those plucky pilot craft which all the year round lie in wait for the coming of the homeward-bound steamship. In these and the fishing fleets are still the finest sailing seamen that one could find round the coast. Their ships are, like themselves, capable of facing anything that blows. Not over-canvassed, they are no light-weather craft, but ready and able to do battle with the fierce and wicked seas which have to be encountered. In some of our ports pilotage is compulsory, and the incoming ship has to pay for this whether she takes a pilot aboard or not. Most of these pilot vessels are cutter-rigged, but some are schooners, and the neighbourhood of Dungeness is a favourite cruising ground for the latter, where big ships coming home "from foreign" can pick up their pilot for the London river, Antwerp, or other North Sea and Baltic ports. By law every pilot is bound to carry with him his licence, to show that he is qualified for the serious task of guiding the ship and her valuable lives into safety. As the Dungeness schooners "stand off and on" from the shore, ever on the look-out, up goes a signal from a big steamship away to the westward, the schooner comes round on the other tack, and stands out to sea. Then, heaving-to, one of the pilot men drops into the boat and is rowed off to the steamship, which has now eased her engines as she comes abreast. With a bump against the great black steel side towering high above the waves, the little frail boat comes alongside, the pilot clambers aboard, the boat is rowed back to the schooner, and the steamer starts her engines again as the pilot ascends to the bridge. At night a steamer wanting a pilot burns a blue light every fifteen minutes, or she may exhibit a bright white light, flashed or shown at short intervals, just above the bulwarks, for about a minute at a time. Pilot vessels when engaged on their work do not show the usual green and red starboard and port lights at night, but instead, in order to show their character, carry a white light at their mast-head, which is visible all round the horizon, and also burn a flare at short intervals.

In bad weather—and that means for a pilot something much worse than what is sometimes thus adjudged in the mind of the landsman—it is not without the greatest difficulty that the pilot can be got from his ship to the liner. The most skilful manœuvring has to be employed, and perhaps the well-known use of oil as a means of protection has to be resorted to. The steamship heaves-to and distributes oil from her weatherside and lee quarter (*i.e.* from her windward side and the side opposite, well abaft midships). Then the pilot cutter or schooner runs up on the windward side of the liner, lowers her boat, and rows round the steamer's stern to the lee (or non-windward) side. The pilot ship then runs down to leeward also, gets out her oil-bags to windward, as well as on her lee quarter. Her small boat, after putting the man aboard the big steamer, also rows round the pilot craft's stern to her lee side, being protected by the oil, both the steamer and the pilot vessel having drifted to leeward gradually whilst leaving an oil track to windward between the two. The manœuvre is as efficacious as it is simple, and many recent experiences have shown repeatedly that the value of oil for modifying the effect of waves is undoubted. The oil is applied by means of small canvas bags capable of holding about a gallon; these bags are pricked with a sail needle so that the oil may leak through sufficiently, and are hung over the ship's side so as to be in the water.

When, on the other hand, a pilot has been shipped to take an *out*going vessel from the harbour, his schooner or cutter awaits him some distance out, and when the steamer approaches, the pilot vessel lowers her boat and comes alongside. Definite localities are arranged for this, such as off a headland or lightship. Sometimes, though rarely, the weather is altogether too bad for the pilot to be taken off, and there is nothing for it but that the man should be carried, an unwilling passenger, to the ship's next port. Just such an incident occurred recently in connection with the Cunard liner *Mauretania.* She had come out of Queenstown in charge of a pilot, but outside in the Atlantic the seas were too much for the man to be taken off, and so he was compelled to go all the way to New York and back, this being the fifth time that such an occurrence had befallen him.

Some of the finest pilots and pilot-boats are those hailing from the Bristol Channel, where tides are strong and waves are steep. Cutter-rigged and with a displacement of twenty or thirty tons, they can keep the sea in almost any weather. All the gear is so arranged that if necessary the vessel can be sailed single-handed. They are of exceptional speed, and often race against each other for many miles in order to get the lucrative job of taking a liner into port. If only two men are on board when they come near the steamer, the boat will be launched overboard, one man will get in and row himself off to the steamer, and then kick her adrift from the side. The liner will steam away, and the pilot cutter will sail down and pick the little boat up, getting her on board by means of a tackle. Then, with this comfortably stowed on deck, away the cutter will sail back home, round Land's End, for many miles, with only one man to handle her and keep the look-out as shipping of all sorts comes running up and down the busy English Channel.

We have essayed in this book to cover as far as possible all the representative developments which the ship has passed through in the course of her adventures and fascinating history. We have seen her adapted both for war and for peace. With the space now remaining to us in this chapter we shall look for a few moments at that other and most modern development, which belongs neither to the class of warship nor really to the mercantile marine. Instead of war or trade, we turn now to the pleasure-ship, the yacht. The development of the yacht, both sail and steam, and now also motor-propelled, is one of the most striking features of civilised sport. And yet practically this is the outcome of the nineteenth century. We mentioned on an earlier page that it was from the Dutch that the yacht was introduced into England, and that Charles II. was the first English yacht-owner. So pleased was the king with this new toy with which to idle away more of his wasted hours, that Pett (whose family we have already mentioned) from his yard at Deptford designed and launched other examples of this species of ship. One of the few good acts that we can attach to the life of this weak-kneed monarch was his encouragement of maritime matters, and his name occupies a unique position in the history of this, the sport of kings as well as now of those of comparatively small means. The first British yacht club was founded as early as 1720, under the name of the Cork Harbour Water Club, which is now the Royal Cork Yacht Club. Only the wealthy could take part in the pastime in those days, and the design and build of the so-called yachts, which much resembled the king's Revenue cutters of the eighteenth century, were very Dutch-like and clumsy. In 1812 a yacht club was inaugurated at Cowes, and, thanks to royal patronage, this in time became the present Royal Yacht Squadron, the only yacht club which possesses the right of flying the white ensign of the royal navy.

Gradually, as racing became more frequent between yacht-owners, the design of the yachts became better and the build less clumsy, for they were unnecessarily strong whilst the Stuart influence was still there, even to the carrying of enormous quantities of heavy ballast. This was the expression of the old-fashioned and erroneous theory that a vessel should be sent through the water by positive force, as it was, and we have seen it to have been, in the days preceding the clippers. It was only gradually that builders learned to bring science into their work, and to realise that a vessel should cut her way clean through the sea with the least possible amount of friction. Some of the bigger yachts resembled the contemporary gun-brigs of the navy, and even carried a tier of guns. We have advanced a long way since this practice, which obtained as late as the 'forties. Then presently lead ballast was introduced, first inside the yacht and afterwards outside; and those prejudices which are characteristic of the seafaring man, and which we have watched manifesting themselves whenever any new idea was launched, were militantly opposed to such a change. But time has long since shown that the objectors were entirely wrong.

Next came an improvement in the cut of the sails, and all the time the gear and details of rigging were being made better and more suited for the work for which they were intended. The clippers in the merchant service began to influence the shape of bow and stern in the yacht, iron was partially employed in her construction, wealthy gentlemen of leisure began to take keener interest in the new sport, and so there was sufficient encouragement for yacht architects and yacht builders to put forth their best. In course of time the excessive beam vanished, the straight stem became the now familiar "spoon"-shaped bow, yachts of all sizes and many rigs were launched, the America Cup contest was inaugurated, whilst at the same time the pure cruiser, as distinct from the "pot-hunter," was evolved; and to-day there is scarcely a suitable port along our coasts which does not boast of its sailing or yacht club. Speaking for a moment away from the historical aspect of the yacht, as one who has enjoyed more years of yachting than there are chapters in this book, it may be permissible to assert that for training the eye, sharpening the powers of observation, inculcating that healthy spirit of resource and cool action in time of peril, there are few, if any, sports or recreations so wholesome and invigorating for a boy and young man as this. Yachting and boat-sailing, away from the tutelage of the professional sailor, develops, instead of diminishing, those faculties which are essential to a man in his battle through life. Not merely will the handling of even a small vessel preserve the sound mind in a sound body, but it will give him also a sound judgment, the ability to make up his mind quickly yet not hurriedly, promptly yet without haste. When he goes out to sea he has the satisfaction of knowing that he is doing—but more scientifically and in a superior craft—what the old Egyptians did before him, the Greeks, Romans, Vikings, the great Elizabethans, and hosts of others after them. For the sea is a great leveller: fisherman or public school boy, pilot or university man, it is no respecter of persons, and the waves and winds are alike for all. The one thing that is asked for and is called forth, besides the requisite skill, is character; and thus arises that curious freemasonry of the sea, a brotherhood which is open to all who love the ships that traverse its deep.

Steam-yachts, because of their increased cost to build and to maintain, are fewer in numbers than the sailing yacht. It is amusing to mention that so inimical was the spirit of the Royal Yacht Squadron, the premier yacht club, to the introduction of steam, that one of their early rules decreed that "any member applying steam-engines to his yacht shall be disqualified thereby and cease to be a member." But this has long since become a dead letter, as the many palatial steam-yachts belonging to some of the members prove. The first steam-yacht of which we have any record was the paddle-wheel steamer of 1825. In 1844 the first screw steam-yacht appeared, being of 300 tons. In snbsequent years, as the value of the steam-engine was gradually appreciated, numbers of sailing yachts were given this addition. To-day one has only to be present at the wonderful assemblage which gathers for Cowes week to see how graceful and how majestic a creature the steam-yacht has become. As engines and boilers have improved in the navy and merchant service, so these improvements have been introduced into the yachts. Already the turbine has found its way into yachting, and the steam yacht *Emerald*, owned by Sir Christopher Furness, of the well-known line of steamships of that name, possesses the honour of being the first turbine-driven yacht to cross the Atlantic. His Majesty's steam-yacht *Alexandra*, launched in 1907, is also propelled by this new method.

Recent years have seen the application of the motor to yachts, some of these vessels being of even three and four hundred tons. Many smaller ones also have been built with these engines as their sole means of propulsion, whilst others still retain their masts and sails for cruising, only using the motor in case of calms or other occasions when advisable. The largest motor yacht afloat, and the first ocean-going vessel so fitted in this country, was the *Modwena*, launched a year or two back. But at present the dangers resulting from the presence of petrol on board a craft have somewhat damped the popularity which the motor seemed likely to obtain at one time. No doubt when these dangers have been sufficiently guarded against the motor yacht will leap into greater prominence.

CHAPTER XVII

THE FISHING FLEETS

ONE of the oldest industries of any country is that of fishing. In the case of the primitive man living by the side of the sea or river, it is one of the first activities in which he is employed, and to the pursuit of this occupation may be traced a very large share of the encouragement which the ship has received during its different stages of history. As man was compelled to go out to sea to gather its harvest whilst his brother workers ashore went into the fields to reap the produce of the land, the tendency would be in the direction of seeking to improve the craft and her gear so that she would be able to be handled to the best advantage in all weathers, and to carry her full cargo of fish safely to harbour. Not merely this, but the industry was training up a race of seamen whose descendants were to become the Drakes and Raleighs and Blakes and Nelsons of subsequent time. The important influence which those hard-weather, illiterate fishermen have had on the world's history is one of those silent facts which mankind has not yet grasped. A country does not beget a band of seamen by keeping ships and men in port. All the shipping that was built in the Middle Ages was not employed in transferring merchandise from this country to the Continent and *vice versâ*, for the simple reason that trade was not so extensive as to need the services of the ship so much. It was on the fishing fleets that the advance of seamanship and ship progress was based, and we may take this assertion as applying not merely to England but to nations as a whole. Before the Vikings were pirates they were peaceful fishermen, getting some of the means of their subsistence from the depths of the sea. Without this experience of the ways of the ship and the conditions of the ocean they could not have become so accomplished in nautical matters.

In our own country the occupation has gone on uninterruptedly for centuries. Some of the fishing-grounds of yesterday and to-day were worked by our early ancestors. Certainly long before the coming of William the Conqueror the herring fishery off Great Yarmouth was a prosperous and important activity. Where many of the East Coast steam trawlers to-day obtain their fish off the Dogger Bank, in the North Sea, there were plenty of ships of the Northern nations thus engaged in their early craft. There are existing records which give the names of some of these ships, and their peaceful calling was seriously interfered with by the pirates which were roving about that sea. One of the English ships of the time of Henry IV., named the *Dogger*, was quietly lying at anchor—the North Sea is notoriously shallow—and her crew were some distance off in their boat fishing, when one of these foreign pirates came up, got aboard the *Dogger*, stole what fish was on board, and made off with whatever contents of the vessel were worth the taking. It is to Henry IV. that the credit is due for having done his best to put a stop to this harassing of the fisherman in his work.

Since comparatively few men who felt the call of the sea could be engaged in the cargo-carrying trade, it was the fishing that found room for their energies and courage. Otherwise, when crews were wanted to man the much bigger carracks and caravels to proceed to the Mediterranean, and later to go on those great voyages of discovery in all parts of the world, there would have been only a handful to meet the demand. You cannot make a sailor of a man by merely putting him aboard a ship; it takes to-day, as it did then, years to train him, even if he has the sea-instinct, which some possess but very many more have not. It has been pointed out, with considerable truth, that had it not been for the excellent seamanship displayed by the west countrymen of England, and their fairly large, if leaky ships, which helped to make up the English fleet against the Spanish Armada, the latter would have had a much easier time during the fights. I am not suggesting that these merchant ships were as sound or as fast-sailing as the royal ships of Elizabeth, but had it not been for the amount of encouragement which the fisheries off the Newfoundland banks held out to these Devonshire men to build and navigate across the Atlantic, we should have been far worse off. To cross that ocean year after year, and to fish off those banks which have been the graveyard of seamen in hundreds for centuries, and still are to-day, necessitated sound ships and proficiency in seamanship and navigation.

From Dartmouth many of the most historic voyages of exploration set forth, and this corner of the world was full of the sea enthusiasm in the days of the sixteenth century. The next port to Dartmouth to the eastward is Brixham, and from here we may trace the origin and development of those fine fishing craft, rigged either as cutters or ketches, which are familiar to most of the readers of this page. To-day, from out of Brixham on the south coast, and Yarmouth and Lowestoft and Grimsby on the east, as well as Ramsgate, the finest examples of this fishing type set out to sea. But the first place must be conceded to Brixham, which in the time of Elizabeth was already an important fishing station. No doubt the reader is aware that a cutter has one mast, with triangular jib and foresail forward, but a rectangular mainsail aft, above which is set a triangular topsail. A ketch has two masts, carrying on the forward one the sails just mentioned, but on the latter a mizzen rectangular sail and topsail also. The difference between a ketch and a yawl is that the former has her mizzen-mast "stepped" forward of the tiller, whereas the yawl has her mizzen-mast abaft the helm.

The two rigs of fishing craft favoured by the Brixham men are first the cutter-rigged ships, which are of about twenty-seven tons, and locally known as "Mumble-bees." These have their mast "stepped" or placed well amidships, and carry very large foresails and a bowsprit of great length. The ketches, on the other hand, are bigger craft, and vary from forty to fifty tons in displacement. They also have their mainmast well away from the bows, whilst the mizzen-mast is rather taller than most ketches carry, and rakes forward at an angle instead of being vertical, as this is thought to be more convenient when the ship pitches. Standing not particularly high out of the water, their bows are bold and raised sufficiently for meeting the attack of an oncoming sea.

To a casual observer, accustomed only to the more refined and graceful lines of the yacht, these fishing craft may seem somewhat heavy and clumsy. But "handsome is as handsome does," and these strong creatures of wood are capable of enduring such seas and weather as a yacht could not so much as look at. In the fine light airs which send a yacht along in comfort the fisherman is a trifle wanting in speed; but as the wind increases in power the trawler begins to be in his element, until a gale will see him riding the seas in comparative comfort while a passing steamer is drenching her decks with the brine. It is said of the Brixham trawler that he rarely doffs his topsail even in strong winds, for they tell you that when the lower sail is reefed the topsail keeps the ship steady in the seas.

Not so many years ago the prevailing fishing rig round the East Coast was the lugsail, which we describe by saying that this consists of a sail set on a yard, the greater part of the canvas extending forward of the mast. The forward lower end of the sail is made fast in the bows of the boat, and when the vessel is beating to windward this has to be let go as the vessel comes round on the other tack, and the sail set the opposite side of the mast. Although this type of sail is still retained in certain parts of the country for fishing craft, notably in Scotland and Cornwall, yet it has serious drawbacks, of which the nuisance of having to "dip" or lower the sail on every tack is the worst. It was owing to this that the East Coast fishermen gradually allowed this type to fall into abeyance, and as the Brixham men migrated eastwards to fish from those ports contiguous to the North Sea, their superior type of rig-cutter and ketch began to be appreciated, and thus to-day the fishing ships of these East Coast ports owe much to the westerner. There are, of course, some slight differences between the east and the west trawlers; for instance, the latter set a larger sail on the mizzen than the former, and the North Sea foresail is also smaller, though in light weather the latter also sets a big jib. The rake of the mast which we alluded to above is also more pronounced in the Brixham type.

The Ramsgate trawler is one of those influenced by the Brixham precedent, and it is only natural that as the west countrymen found the harvest in the North Sea more plenteous than their home waters, they should sail east. The Ramsgate class is about the size of the Brixham "Mumble-bees," or a little bigger, but not so large as the west country ketches, for the reason that there is an important difference between the two harbours. Brixham is open and more spacious, but Ramsgate has a narrow entrance, and as a rule the trawlers spend what time they are not at sea in the inner harbour or dock.

The Lowestoft "drifter" is usually about thirty tons, and has no boom on her mainsail, but she has that interesting relic of the Middle Ages, the bonnet, which laces on in much the same way as we saw in an earlier chapter. The "drifter" catches her fish in a manner different from the trawler. The former, having arrived at her fishing-grounds, puts out a number of nets which cover the sea to the extent of a mile or so. These nets are buoyed at the top by means of corks, but the lower edge is sunk by means of lead sinkers. These nets are left in the sea thus hanging straight down for some hours after sunset, when they are usually set in the vicinity—"shot" is the North Sea expression—where there is supposed to be a school of fish. The mainmast is lowered on deck, but the mizzen and its sail are kept up so that the vessel will ride head to wind easily. The bow is also made fast by a strong rope until the nets are hauled again. The trawler, on the other hand, dispenses with the drift-net, and uses a trawl, which consists of a strongly constructed bag-net. This is thrown overboard, attached to the ship by a stout rope, and as the vessel goes through the water, the mouth, which is extended by a strong beam, receives the fishes. The East Coast trawlers are fine sea-keeping craft, like their western sisters, and are mostly ketch-rig, varying from about sixty to ninety tons.

The Plymouth "hooker" is another type of fishing craft well known to those who go up and down

Channel. She is cutter-rigged, but of a kind entirely her own. Thus her mainsail has no boom, and although this may be a disadvantage when beating to windward in light airs, yet it is a convenience in bad weather. With her short mast, her square stern, and her unusual topsail, she is one of the features of the west of England seascape.

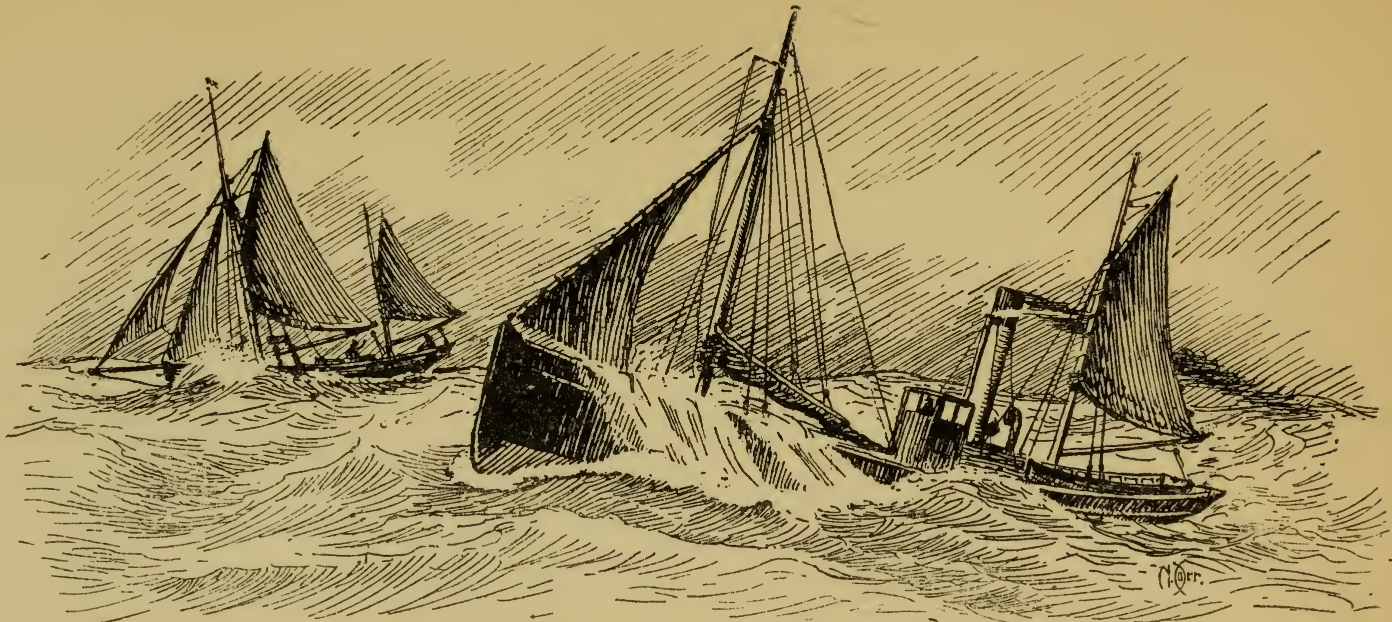
Much more like yachts than fishing craft are the beautifully modelled fishing-boats which go out from Poole at sunset to toil for their living while people ashore are sleeping. With their white-painted hulls and large topsails, looking very much like a dinghy's lugsail, they are splendidly fitted for their purpose, and from their Dorset crews some of the most skilful paid hands on our crack racing yachts have been selected. No one who has sailed with these cheery men and admired their keen sense of sportsmanship and their fine seamanship can have anything but respect for them. To watch a fleet of these beautiful little ships come creeping into the long, lagoon-like harbour with the first of the flood tide, as dawn on a summer morning is just breaking, is as pretty a sight as mortal eyes could wish to see.

The Cornish fisherman favours the lugsail for his craft, and the reader must have seen many a modern painting in which this type of vessel is depicted. Many of the Cornish ports dry out at low tide, and so their boats have to be so built as to take the ground easily. They are built of great strength so as to be able to stand the force of the seas which come rolling up the Channel from the Atlantic. They are two-masted, setting a lugsail on each as well as topsail over the mizzen, and their size is about fifteen or twenty tons. As the mizzenmast is placed right at the stern of the vessel, in order that the sail may be hauled in or slacked, the "sheet," or rope by means of which this is done, leads through a long spar, called an outrigger, which projects from the stern in much the same way as a bowsprit projects from the bows of a ship. The Scotch lugger has a much higher and squarer cut of sail than the Cornishman, and does not as a rule set a topsail over the mizzen. Their sea-keeping qualities in the treacherous weather which blows along the Scotch coast are so well known that it is not necessary here to emphasise the fact. In both Cornwall and Scotland the motor is already beginning to be installed in the lugger, to the great convenience of the crew and the increased efficiency of the craft. As an instance we may refer to a little ship hailing from St. Ives which recently had a motor put into her. In the autumn it was a question of laying the boat up for the winter or placing an auxiliary engine into her, because with bad weather always lurking about, and the possibility of treacherous gales close at hand, it was essential, if the boat put to sea, that she should be able to get home again as soon as matters were looking threatening. On one occasion the nets were "shot" in one of the Cornish bays, but at nine o'clock, as there were no fish in them, they were hauled aboard, and the engine soon carried the boat to a place sixteen miles away, where the nets were "shot" again at twelve o'clock and no less than 16,000 herrings secured for the market. Another motor-propelled Cornishman found his engine so handy that within seven days he had taken fish of the value of £100.

So determinedly, indeed, are both steam and motor driven engines being introduced into fishing craft, that the Board of Trade have recently published an important order affecting the skippers and mates of "drifters." It is along the East Coast that the steam trawler is beginning very much to oust the sailing fisherman, and steam "drifters" also have now to be reckoned with, though perhaps not to the extent of the steam trawlers. Grimsby and Yarmouth contain plenty of the modern steel-built steam type, and it was on some of these that the ill-fated, panic-stricken Russian fleet fired during that memorable night when the Russians, crossing the North Sea, came upon the steam trawlers harmlessly pursuing their work, and misguidedly and unwarrantably took them for Japanese war vessels, with fatal results to the poor fishermen. The writer happened to see one of these trawlers just after she was repaired to make good the damage which the Russians had so ruthlessly made. From the amount of new material that had to be put in, it is a wonder the vessel ever reached port at all.

Let no one be so foolish as to despise the steam trawler because she is but a fishing craft and lacks that spruceness and neatness which characterise some of her less industrious cousins. This vessel is a heroine among ships, even if she has the appearance sometimes of a rusty hull and smoke-begrimed rigging. Never a wintry gale blows but one of these gallant ships finds some rescue work awaiting her in the tempestuous North Sea. With the deeds of her crew's heroism, and the escapes from death which the engine-driven trawler has encountered, one could fill the whole of this book. As she has proved many a time over, this type of craft can go anywhere and stand almost anything that the sea can put up against her. It is only occasionally that she comes off second best, but she dies fighting, and her crew with her. If ever there were a case of the romance of the ship being perpetuated after sails have been discarded, surely here in the steam trawler we have it; she is little else than romance from the day she first goes out to the Dogger Bank to the time when she is condemned to her doom, and when the time comes for her disappearance before the superiority of some more wonderful species of craft, her memory deserves to be perpetuated in letters of gold. The liner and the steam yacht can stand for dignity, massive grandeur, and beauty, but the steam trawler for sheer hard work and courageous conflict against the most trying experiences the sea can conjure up.

Her history we can sum up briefly as follows. Steam was known in the fishing industry before the steam trawler, for the practice has not yet died out of carrying a boiler on the sailing smack for driving the winches for hauling up the nets and warping into dock. For a time a particularly fast carrier, driven wholly by her sails, was employed to bring from the North Sea to Billingsgate the catch of the fleet, and then to return to the ships fishing. Presently, as steam began to be introduced into merchant ships, it was found advisable to abandon the sailing for the steam carrier. By this means the perishable cargo got to market in the shortest time, and



A STEAM DRIFTER AND A SAILING TRAWLER

Few ships are more romantic than the fishing craft. Steam is rapidly ousting sail in these as in other fleets.

the financial remuneration increased. Then, as well as the sailing trawlers, clumsy old paddle-wheel steamers which existed at fishing ports for towing ships in or out of harbour were sent forth to try their luck, and so successful were their efforts that already the future of the steam trawler was assured. Ketches were given engines, not of great speed, but of great service in hurrying out to the fishing-grounds and home again. Constructed of wood, with iron bulkheads, as some of the earlier ones were, and the engines and boilers placed right in the stern of the ship so as to allow all the possible space for the hold to contain the fish, the mainmast was fitted for lowering as in the sailing "drifters," and the forward portion of the ship was reserved for the crew. Such vessels as these belonged to the early 'eighties, and were driven by a single screw at a speed of eight knots.

Then gradually bigger vessels were built so as to hold more fish, and the size was increased to a couple of hundred tons or nearly so. Wood gave way to iron for building the hull, the engines were made more powerful, water-tight bulkheads were added, and with greater bunker space the steam trawler was able to extend her field of operations and leave those nearer grounds where the fish were running scarce. To-day, fitted with all sorts of labour-saving gear of a modern and improved type, the steam trawler is able to cruise for her living as far south as the Mediterranean, and even farther, as far north as the Arctic fringe, and right away west into the broad Atlantic. As her size and equipment have increased, so also has her money-making power, because she can go where the fish may be, and not confine herself to home waters. Fitted with a complete refrigerating installation for preserving the fish, she is able to get her hard-won cargo to the market in a condition sound and fresh. In South Africa the Cape Government has already stimulated private enterprise, and there are now few quarters of the globe into which the steam trawler has not penetrated.

It is well known that no foreign trawler is allowed to fish within the three-mile limit of another country's shore, and this infraction of the law is not altogether a rare occurrence. For the preservation of these rights, cruisers known as fisheries-protection vessels are employed, and periodically go out and return sometimes with a captured foreign trawler in tow, involving confiscation of the latter's catch and other penalties. The general superintendence of fisheries is exercised by the various navies of the powers, who, among other details, see that the fishing fleets are properly marked and numbered with reference to their respective ports.

Off the Banks of Newfoundland, cod-fishing, are to be seen the finest schooners in the world, which come out of Gloucester, U.S.A. For beauty of form, for speed, for sea-keeping qualities, they are little short of marvellous; but in this case the fishing is not done by nets or trawls, but by lines from open boats known as "doreys." Many a time one of the customary fogs which frequent this locality springs up, completely obliterating the schooner from the sight of the men in the "doreys." A wind may follow and increase into a gale, and, hidden from view in the trough of the deep Atlantic billows, the dorey men may shout away, but their doom is sealed and the schooner can find them not. Instance after instance, outside fiction, of this happening has come to the writer's knowledge, and sometimes the ill-fated men, fasting for four or five days, delirious with hunger and thirst, their hands almost frozen to the oars, have been sighted by the look-out man in the "crow's nest" of an Atlantic liner racing across with the mails. The engines have been stopped, a boat lowered, and the poor starving men have been literally snatched from the jaws of death. Sometimes, too, when the fog shuts down and the liner is speeding on, there may be a fleet of schooners dispersed about the track of the steamer. There is a sudden snapping crash as the sharp bows, with a mighty force behind them, go crashing through the fishing ship, and all that follows is a few bits of splintered wood and a few households in Gloucester to mourn for the men who will never come back. There have been for generations French fishing ships which sail across every year to this region, but they are not the fine, well-found beauties which are seen in the schooners of the United States. Not seldom some of these French craft find the Atlantic too strenuous a foe and end their days therein. But now a new chapter is beginning. The Gloucester men have tried what advantages were to be obtained by installing a motor in their ships, but these seem to have received but scant appreciation. From our side of the Atlantic, however, there is being sent out a much larger and even more seaworthy type of steamer to the Newfoundland Banks, built after the type of the steam trawler, and with her we may bring the perfection of the fishing vessel to its final stage.

In many a fishing port along the coast you hear the same cry, that the fishery harvest is going from bad to worse, and this fact, together with the increased power of the steam trawler, is taking our fishermen always further away from the homeland. At one time there was a small but lucrative industry done in whaling, but much of that now belongs to the days that are gone. However, the present conditions are exactly the reverse of those we indicated at the commencement of this chapter. Whereas at one time the fishing employed many men and cargo-carrying few, to-day it is just the other way about. But for all that it is not likely that the sea will ever have yielded up its last load of fish as long as there are men ready to go out to catch them.

If there should come a disappearance of the world's fishing fleets, there would vanish also some of the finest deeds of heroism, some of the most brilliant acts of seamanship, and some of the sturdiest of human characters to be found in any of the world's activities. Unfortunately, owing to the maze of complicated detail with which a man must be familiarised when quite young, the navy cannot nowadays afford an alternative opening for the ex-fisherman. The two duties are separate and distinct, for seamanship counts for practically nothing on board a big battleship, whilst gunnery is of as little use to the fisherman. No longer would it be possible, as it was in the time of the Armada, for the man who has been engaged in "reaping" the sea to leave his work for a time and stand by his country, afterwards, at the resumption of peace, to return to his nets and his fish. We have gone on specialising too much for that, but the pity is, none the less, that such able seamen cannot be found a suitable scope for their sterling characters and abilities.

CHAPTER XVIII

LIFEBOATS AND LIGHTSHIPS

HITHERTO we have always dealt with some species of the ship which, with more or less regularity, is employed in her voyagings from place to place or from home to the sea and back again. In no case that we have seen has she been tied down to the same spot for almost the whole of her career. But now we come to consider two separate kinds of craft which are more or less stationary. The lifeboat is in most instances scarcely ever afloat, and remains on shore in readiness for the signal which shall send her on to the waters no matter what the weather. Strictly speaking, she is only a boat, but she has grown to be as large as many of the small ships which we have been discussing. The lightship, again, is a ship that never gets under way except for those exceedingly rare occasions when she is taken into dock for repairs and refit. And yet, though neither of these distinct types contributes anything to the progress of the world directly, yet without them death from shipwreck would be far more frequent, so that they are, each in its own way, indispensable.

The introduction of the lifeboat, and the prototype of the modern life-saving apparatus by means of a rocket taking a line from the shore to the ship, dates only from the beginning of the nineteenth century. In olden times when a ship was in distress, either she had to founder, or the crew did their best to make rafts of casks, spars, or hatches, and entrust themselves to these, and it was not till almost the ninth decade of the last century that legislation required adequate provision to be made on board a ship for preserving life in such perils. But with ships' lifeboats as carried on davits we have no intention of dealing, for they are comparatively small, and exist in no way independently of the ship herself by which they are carried.

Although in the previous century there were lifeboats of sorts, yet they did not possess the capabilities which one to-day associates with this type of craft. It was not until about the middle of the nineteenth century that the lifeboat proper began to be. The shape was taken from that of the boats which are sent out from whaling ships and lie in wait for the monsters of the deep. Those who have read Mr. Frank Bullen's "The Cruise of the *Cachalot*" will recollect that the boat employed is double-ended, that is, shaped with a bow at either end; but this is really a survival of the Viking influence, and is but a further proof of the right judgment which the early European boat-builders possessed. The advantages of this shape are twofold: first, in the event of a following sea the boat is more likely to give a good account of herself with this power of cleaving the waves; and secondly, for the very same reason which is recorded of those ancient Northern ships in Latin literature, that a craft with a double-ended formation can easily be rowed in either direction. These characteristics are both essential for the lifeboat when it is only with the greatest difficulty that a sinking or stranded ship can be approached in bad weather; but for these two capabilities the lifeboat would be little better than a common shore-boat. In order to make her as dry and seaworthy as possible, the lifeboat was made with protecting gunwales of sufficient height at either end. Some of the early lifeboats were built of elm and copper-fastened, the sides being fitted with lockers, which sloped upwards from the thwarts, or seats whereon the men rowed, to nearly the gunwale's edge, and these were filled with cork. The Viking-like ends of the ship, instead of being left open as in a whaling-boat, were decked, as we see them to-day, and fitted with bulkheads enclosing air-tight canisters. Thus both bow and stern, no matter whether the craft was rushing into a head sea or running before a following one, were both protected from the waves and the ends made more buoyant. The advantage of this is too obvious to require further mention. The cork sides did not extend to quite the ends of the boat, which was about 20 feet in length, with a breadth of 6½ feet, and a depth of about 2½. Such a lifeboat as this was built in 1840 for use at Brighton. The boat was, of course, propelled by oars, and, following the practic again of the whalers, was steered by a long 17-foot oar from over the stern. Instead of the familiar rowlock in which the oars are usually placed, the latter were placed between two pegs of wood known as thole-pins, "gromets," or circular strands of rope, being attached, so that in case of accident the oar was not lost. In some parts of the country, especially on the East Coast, and even at one part of the Dorsetshire coast, a similar arrangement is effected by piercing the oar so that a pin fits into it. With this convenience the fisherman who rows out to his lobster-pots can have both hands free for his work, and let the oars float idly without risk of losing them. The Brighton lifeboat we are speaking of was also fitted with a roller, so that, an anchor being taken out ahead from the beach seawards, the process of launching could be made easier by hauling the boat out into the water.

It must not be thought that all modern lifeboats are of one type. Owing to the varying local conditions, and it may be said local prejudices, there are several designs. For instance, a shore that is rocky and enables a convenient slip to project straight out into deep water is more suitable for a bigger and heavier lifeboat, whereas in the case of a soft sandy beach the difficulty of launching even a light boat in bad weather may be considerable. But the main object which influences the design and build of the modern lifeboat is that she may not founder by swamping. If a sea breaks over her she will immediately empty herself. In the olden days, when the lifeboat was just beginning her career, this principle was not appreciated; she was rather a craft which, when she was swamped, would yet keep afloat even with her crew aboard. Some of the boats became much larger in size in the 'fifties, were fitted with air-chambers at the sides as well as the ends, and were given sails as well as oars. Outside was added a thick strake made of cork, which, besides adding to her buoyancy when the boat was full of water, was also a protection when coming alongside a distressed ship, and the waves rose and fell endeavouring to hurl the rescuing boat against the more powerfully built craft. In order to increase her "stiffness" the boat was given an iron keel of good weight. Subsequently the use of air-chambers was further extended by placing them also beneath the thwarts or rowing seats.

In order to gain additional strength to the hull, the building was also made of two thicknesses of mahogany laid diagonally; and there are plenty of lifeboat craft to look at if the reader desires to notice this feature. The boat was so made that should she capsize she would right herself again, for she was so supplied with air-cases and had so heavy a keel of iron that she was bound to return to her proper position on the water. The modern principle of enabling the boat to relieve herself of the water which had been shipped was also introduced about the 'sixties, this being done by means of large valves, so that within twenty seconds from the shipping of a sea the boat would have emptied herself again.

But even a self-righting boat is not much use if she cannot be launched. We have already hinted at the difficulties which in certain cases attend the floating of the lifeboat, and so a suitable transporting carriage was designed, which also enabled the boat to be hurried across country to a bay or beach further along the coast whence signals of distress have summoned her. In certain parts of Scotland, for instance, where villages along the shore are few and scattered, this transportability has many a time saved human beings from a watery grave.

This carriage was so designed that when it was brought down to the beach the boat moved down from an inclined plane into the sea, with her crew already on board, and when the surf is breaking savagely on shore the value of this method of launching is incalculable.

The self-righting type was found so highly efficient that it is still the most extensively used, and most of the boats are of smaller size, for they are employed principally along those coasts where they have to be launched from the beach. The state of the wind or tide may be such as to prevent the boat being put into the sea from the customary spot, and a more favourable position has to be found some distance away. The reader will easily appreciate the fact that supposing a vessel has had the misfortune to strand on a dangerous bank between the shore and the deep sea and has summoned the lifeboat, and it is found that the normal launching place involves a hard row or beat to windward against tide as well, it will be a much easier matter if the boat can be carried on her carriage along the shore past a point opposite to the wreck; for then, dropping down with favourable wind and tide, she can make the distressed ship with comparative ease.

If a "self-righting" lifeboat were to capsize so that she lay on her inverted bow and stern, she would be found so unstable, poised on these air-boxes, that, with the additional help of the heavy iron keel now making her in this position top-heavy, she would be bound to right herself and return to her correct position. These end boxes are built with an arched roof, and if necessary can be entered by means of water-tight doors. The length of this type is about 34 feet and 8 feet beam, and the boat is fitted with lugsail and jib as well as oars. Larger boats are made with iron plate drop keels, which are pivoted at the forward end as in the familiar case of the sailing dinghy, two masts being provided. In order to increase their stability, some of these have also adopted the practice, which we saw introduced into liners and men-of-war, of carrying water-tight compartments for water ballast. The water is admitted, after the boat is launched, below deck amidships, and can easily be emptied. Some of these craft are as big as a good-sized trawler, being over 40 feet in length and 11 feet wide. In the case of the water-ballast type, if the boat should capsize, then the spilling of this water when she is bottom upwards assists her return to her right position.

The innovation of the air-boxes has been employed to its furthest limit in the modern lifeboat, so that every available space is taken up with these above deck and below, so that if, when coming alongside a ship, the boat should be stove in, the buoyancy is still there. The pipes which conduct the shipped water out into the sea again lead through the bottom of the boat, and to prevent the return of the sea through the same channel they are fitted also with special valves, precluding this possibility.

We mentioned just now the factor of local prejudice affecting the type of lifeboat adopted at certain places. Norfolk and Suffolk are an instance of this, for the self-righting craft has never been accepted along this coast. As many of my readers who have sojourned in those parts are aware, these are bold, powerful craft, nearly 50 feet in length, and are minus the air-boxes at the ends and sides, but are partially decked, at bow and stern and along the sides, leaving the centre open and free for the crew. They have the water-ballast compartment on a large scale, and relieving tubes as well, though a few have introduced air-cases, as in the self-righting boats, below decks. It seems to the average being somewhat obstinate to cling to this old-fashioned non-righting type, but it is the firm choice of the local fishermen, and since it is they who have to put out in them their wishes are consulted in the matter.

Some lifeboats are usually kept afloat, and not in their houses on shore, and in this case there is not the strong objection to their weight which has to be reckoned with when launching becomes necessary. Fast and weatherly, powerful and able to endure a good deal of knocking about, they are less suitable for rowing than sailing, and have more claim to the title of ship than boat. Nowadays the steering is controlled not in the old whaler fashion, but usually by means of a rudder. The steering-oar is not without its use still, as, for instance, when the conditions of the sea are such that the boat needs assistance in coming round from one tack to the other. Tillers are used to connect the rudder, but in some cases even that has been modernised by adopting the wheel which is always used on big ships.

Progressing with the times, oars and sails in lifeboats are being replaced in certain parts of the country, where local feeling allows of the innovation, by steam and motor propelled lifeboats. An ingenious arrangement which was introduced in the 'nineties showed a lifeboat fitted with steam-engines, which on land drove two travelling wheels, but when the boat was in the water worked her ahead by driving a stream of water through certain pipes placed below the water-line, the reaction of the issuing jet propelling the boat. There are four pipes, two forward and two aft, and when the ship is to go ahead the forward ones are closed by valves and the two after ones opened. Steam can be got up in a quarter of an hour, and the boat will travel at eight knots for thirty hours. Other lifeboats are fitted with the usual shaft and propeller as seen in steamships generally. But the advent of the motor has no doubt increased the capabilities of the lifeboat without in any way detracting from her sea powers. A couple of these motor-boats recently made an excellent passage from the Thames estuary to the north of this kingdom, encountering bad weather on the way, but proving themselves to be all that could be desired. There are certain disadvantages in using the steam-propelled lifeboat, but in the motor there are but few of the drawbacks which are bound to be present in one way or another when so unique a ship as the lifeboat has to be considered. All ships and boats are a compromise of some sort, and the lifeboat is perhaps the representative of the most acute manner in which conflicting considerations have to be weighed and allowed for. She is required to be fast, yet suited for the vilest of weathers; she is to be safe, yet able to carry as many people as possible from the wreck; she has to be strong so as to endure the battering of the seas and the banging against a ship's side, and yet in most cases she must be kept so light that she can be transported down the yielding beach or across miles of rough hilly country roads to the place where duty calls her. That she fulfils all these conditions, and others as well, is the result of time and experience coupled with the help of naval architecture and science. Most of three hundred of these craft under the Royal National Lifeboat Institution are stationed along our coasts, and wherever it can be shown that, judging from previous disasters, an additional lifeboat is needed, the Society establishes and maintains such a craft. The local fishermen are encouraged to interest themselves in the life-saving work by granting to them medals and monetary rewards, which are paid without delay as soon as proof of the merits of each case is forthcoming. Mariners who sail round the land are able to know where a lifeboat is stationed by reference to their charts, which mark these spots.

Turning now from lifeboats to lightships, we come across a very different but not less useful vessel. Perhaps there are few readers who have not passed them at one time of their lives, though not always realising how valuable they are as aids to navigation. They form so prominent a feature in the mariner's life nowadays that one is apt to forget that their use is practically of modern origin. The first lightship dates back only to the year 1732, when Robert Hamblyn and David Avery established such a ship at the Nore, where the entrances to the "London River" (as sailors call it) and to the Medway converge. Finances for the upkeep of this were obtained by toll. To-day, of course, this and all the other lightships of England and Wales are under the care of the Trinity House, which was originally founded about the time of the sixteenth century. The second lightship was the *Dudgeon*, placed off the Lincolnshire coast four years after the Nore light was put into position. These early ships were about 80 feet in length, and carried a mast and yard with a large red flag at the mast-head. By night candles were burnt in a lantern, after the manner which prevailed in the navy for stern lights and had been inherited from the times of the Middle Ages. At the end of each yard-arm was hung one lantern, and when the lanterns needed attention the yard was lowered down on deck; when it required to be hoisted up again, this was done by means of a winch. During foggy weather a bell was sounded, which is still the regulation signal for ships at anchor in a fog, though the more modern siren is usually employed now on board lightships. These old lightships were anchored, of course, and their cables were not of chain, but, following again the prevailing custom on ships of the navy and merchantmen, were of hemp, which, for riding to in bad weather, gives greater comfort, when the wind and waves and tide cause a ship to give a sudden jerk and to exert a sudden strain on the cable which keeps her to her anchor.

All lightships in Great Britain are painted red, with the name of the vessel—usually taken from the name of the shoal or sandbanks off which they are placed as a warning—painted in large white letters on each side. In Scotland these ships are under the control of the Northern Lighthouse Board, which dates back to 1786, while the Irish Lighthouse Board is responsible for those in the waters of the Emerald Isle. But the latter are marked differently from those of the United Kingdom, being painted black, with the name in white letters as before.

The light vessels of the United Kingdom at night show a white riding light placed at the bows, six feet above the rail running round the ship. This enables the mariner to ascertain which way the tide is running, for, except when the wind is against the tide, the light vessel will naturally ride head to tide. All light vessels having only one principal mast are fitted with a small mizzen-mast at the stern. By this means during the daytime one can tell at a distance how the light vessel is "swinging," *i.e.* in which direction she is riding to the tidal stream. This mizzen is also used for setting a small sail, known as a trysail, in order to keep the ship's head towards the wind when in a gale the tide is against the wind and the ship "sheers" about in an alarming manner. All light vessels have also a day-mark, which usually consists of a ball hoisted up to the mast-head, so as to distinguish her at a long distance from other shipping. Where light vessels are fairly numerous or close together—as, for example, at the mouth of the Thames—this mark is varied.

The lantern, which is hoisted at sunset up the mast thirty feet above deck, is a large circular arrangement containing oil-lamps with powerful reflectors and lenses. A vessel coming up Channel and not being sure of her position, and suddenly espying a light from a lightship or lighthouse, is able to discriminate between various lights by the difference in their characters. Thus, they may be fixed, showing a continuous steady light; or they may be "flashing," showing single flashes at regular intervals, the duration of the light being less than the darkness; or, again, they may be "occulting," that is, giving a steady light, with at regular intervals sudden and total eclipses, the duration of the darkness being never greater than that of the light; or they may even be "revolving," when the light gradually increases to full brilliancy and then decreases to eclipse. The vessels nowadays are moored to the bottom of the sea by means of "mushroom" anchors—thus called from their shape—weighing several tons, though varying with the size of the ship, and an enormous scope of cable. Whenever it happens that, owing to an accident, the lightship is unable to show her main light up the mast, she will exhibit only her riding light, and passing vessels will know that although her other light is not working—revolving, occulting, flashing, or whatever its nature—yet the lightship is still in her proper position and marking the dangers. But if, as happens very rarely indeed, the lightship breaks adrift from her moorings during a gale and becomes no longer a guide to shipping but out of control, she shows no light except a red one fixed at each end of the vessel, and every quarter of an hour burns a red flare. By day she would show the same indication by lowering her daymark.

All the time the crew on board are keeping a careful look out, and should any passing ship be seen to be standing into danger, as perhaps getting too near to a dangerous shoal, the light vessel hoists two signal flags, "J. D." of the recognised international code, signifying, "You are standing into danger," and also fires a gun to attract the attention of the ship thus warned. The signal is kept flying until it is answered by the other, and if necessary the gun is fired again.

It is during foggy weather that the monotonous life of the lightship men becomes both anxious and exciting. Lightships are like magnets to shipping, and at all times there is a ceaseless procession of shipping of all sorts passing in close vicinity. During thick weather, lack of wind and the force of a strong tide may carry a big sailing vessel on to the bows of the lightship with a sickening thud and crash, or a throbbing steamer may come looming out of the fog and cut the warning vessel through. In order to signal her whereabouts, the lightship blows her siren or reed-horn (worked by a hot-air engine sometimes) at regular intervals, some of them giving first a deep bass note and then going off into a piercing, hysterical shriek. It is thus that the different lightships may be recognised one from another. Creeping silently through a fog at sea, hearing nothing but the distant thrashing of a steamer's propellers, and knowing the possibility of all sorts of craft suddenly tearing out of the dark curtain, with the siren getting dimmer or louder, is anxious work for any one responsible for his ship and her contents, but it is about the same for the lightship men.

Some light vessels—as, for instance, the North Goodwin lightship opposite Ramsgate—are connected to the shore by means of a telephone. The *Sunk* lightship, moored in the North Sea near the Sunk shoal, nine miles east of Walton-on-Naze (near Harwich), was fitted in 1885 with electrical appliances and telegraph cable to the shore; but the latter soon broke. Special arrangements were made to prevent the mooring chains of the ship damaging the telegraph cable, and connection was resumed with the land. Now, however, wireless telegraphy is adopted on this ship for life-saving purposes, summoning assistance from shore. We may mention that off this lightship is the favourite cruising ground for the pilot cutters which lie in wait to put a pilot aboard those ships bound for the London river, or to take off the pilot who has brought ships out from that locality.

A lightship's crew consists of master, mate, lamp-lighters, and three or four seamen, whilst others are ashore until they come back to relieve those aboard. These ships are now specially built for their work, and, because of the enormous strains which in bad weather they have to encounter, it is essential that they be built of remarkable strength. With the interior divided up into cabin, tanks for the large quantities of oil which must be kept for the lamps, the deck contains the boats, the siren, guns, as well as the winches for lowering and raising the lantern. Wood was formerly used, but that has now given way to the use of steel. It is a lonely life that these men lead, but occasionally in fine weather a passing yacht may be able to approach close enough to throw a batch of papers and magazines on board, or to catch a bundle of letters to be posted to the men's relatives ashore. Their lot is worse than that of the lighthouse-keeper even in such out-of-the-way places as the Eddystone Rock, for at least the foundations of the lighthouse are safe; but week in, week out, with the ship never still for a second, and "snubbing" at her cables, there are few of the pleasures of existence which to the landsman are indispensable. Bad enough in the summer months, and worse in the long winter, always afloat over the same spot, with a perpetual watch to be kept in all weathers, such an existence is trying even to men who have been brought up to the sea and fought with it for most of their lives.

CHAPTER XIX

THE SAILING OF THE SHIP

THUS have we traced the history of the ship in her progress through the flight of time, and witnessed all manner of changes and her development in countless special ways. In historical sequence, as far as possible, we have endeavoured to follow her evolution, and to notice at the same time the forces which were at work to mould her along certain definite lines in different epochs. But before we end our task, let us take a glance at some of the conditions under which the ship of to-day has to fulfil her calling; let us see something of the manner in which she is found serviceable as one of man's best and most amenable friends and helpers. We could extend our inquiry to great length, but it will suffice if we indicate some of the lesser known and, to the general reader, unsuspected matters which have to be taken into account in her usage.

Legislation has during the last hundred years done much to improve the lot of the seaman, and to discourage the employment of unseaworthy, overloaded ships. Before leaving port the ship's draught of water must be noted and entered in the official log-book, and it is compulsory for all British ships, excepting small coasting vessels, fishing craft, and yachts, to be marked with load-lines. Perhaps those who may read this book will have often wondered at the meaning of those strange letters which one sees outside, amidships, on a cargo vessel when lying alongside a wharf in port. There are white lines painted on to the ship's black hull, indicating the maximum depth to which a ship may be loaded, but these are of different kinds. Thus, supposing the port is one of those which connect with an inland water, and the vessel has gone through a lock to load up alongside a factory or granary, since fresh water is less buoyant than salt the ship will actually rise higher out of the water when she has emerged into sea water once more. Thus it is necessary to have white lines marked to show the maximum depth to which the ship can be loaded both in fresh water and in salt. These maximum load-lines are distinguished by initial letters, and the reader cannot have failed to notice "F.W.," which means "Fresh Water," "I.S." indicating the load-line for vessels voyaging during the fine-weather season in the Indian Seas, "W.N.A." for winter voyages in the North Atlantic, during the months of October to March inclusive, from any European port to the United States or British North America.

And here let us refer to a matter which may seem to upset a well-known statement of our old friend Euclid, who tells us that the shortest distance between any two points is a straight line. In the navigation of the globe this is not applicable. For instance, suppose a liner wishes to get from Land's End to New York, her shortest way will not be to go in the straight line which would join these two points, that being impossible for the reason that the world's shape is not flat, but round. Therefore her nearest way, and the shortest practicable distance between the two points, consists of a curve—in other words, an arc of a circle. If the reader likes to try an experiment with a piece of string and a globe he may be surprised to find that this is so. This method of navigating is known as "Great Circle Sailing," great circles being those circles whose plane passes through the centre of the earth; thus, for instance, the equator is a great circle. The shortest distance in which a ship can sail from one point to another is an arc of a great circle. Nowadays, when every minute of a liner's passage is valuable, and the keenest effort is made to get the ship in port with the greatest possible saving of time, the navigator must needs be familiar with such higher branches of his duties as this. To follow this interesting point any further would be to involve the reader in matters of navigation and seamanship, which he would possibly be unable to follow without a knowledge of the sea terms employed, but it was deemed worth while that this interesting question should be here raised.

Nor must the reader confuse seamanship with navigation, though both are essential for an officer in any ship that goes out of sight of land. Seamanship includes the details connected with the handling of the ship, the knowledge of working the sails, the rule of the road at sea, the use of the lead-line for fathoming the depth of water under a ship, mooring and anchor-

From a photo by *Mansell & Co.*

"Off Valparaiso"

(*After the painting by T. Somerscales*)

This shows a modern ocean-going sailing-ship in the act of taking in sail as she arrives at the end of her journey. This beautiful type of ship is rapidly being chased off the seas by the modern steam-driven vessel, but many are still to be found such as that here illustrated engaged in the carrying of timber, grain, and other commodities from the American continent to Northern Europe. Notice the retention of the old-fashioned method of painting on the square ports along the hull.

ing, signalling, and so on. But navigation is the art of conducting a ship from place to place, and includes such matters as fixing the position of the ship when out of sight of land, finding the latitude, taking bearings of any object seen on shore from the ship, being able to work out on the chart a compass course, allowing for the leeway (or drifting to leeward) of the ship, the direction of the tides, and so on. The master or captain of the ship is responsible for seeing that the navigation of the vessel is carried out in an efficient manner, and, apart altogether from his duties as a sailor, he holds the position of absolute authority over every one aboard as long as the ship is at sea. Nowadays, when the character of ships, whether naval or mercantile, has become of so complex a kind, his duties and responsibilities have multiplied enormously. He is the central head of so many departments, and yet all the time his principal work consists of getting the ship and her contents safely across the sea from one port to another.

The chief officer on a liner ranks next to the master or captain, and his duty consists of attending to the care of the ship, being, so to speak, a sort of vice-captain. The men who are directly responsible for the navigating of the ship, seeing that the steersman keeps her on her course, and that the correct speed is maintained, are the second, third, and fourth officers, though in some cases the first officer stands watches with the junior officers. When at sea the officer on duty is supposed to be on the upper bridge, and there he is to remain, being forbidden, until he is relieved by the officer of the next watch, to go below.

In view of the possibility of a liner becoming disabled owing to any breakdown of her machinery or other cause, an arrangement has now been made between certain steamship companies whereby fixed routes are followed by those ships engaged on the South Atlantic route to the Cape of Good Hope, and so on, so that a disabled ship runs the chance of being sighted and assisted by other ships of the same route. For the North Atlantic route the principal steamship companies have an agreement to keep to certain specified routes, both west-bound and east-bound, from January 15 to August 14 inclusive, and a somewhat different route for the other half of the year. When ice is reported prevalent in the North Atlantic an agreement is made between the various companies to follow routes to the southward of the usual tracks.

It is scarcely necessary to remind the reader that a ship finds her way by means of a compass. In order that the compass card may not buckle up when the ship is in hot climates, this is made of mica covered with thin paper. In wooden ships, where there is an absence of iron in the vicinity of the compass, the latter will be fairly accurate; but when a ship is built of iron or, as most modern vessels, of steel, the compass is liable to considerable errors. It is an interesting and often forgotten fact that, owing to the riveting and hammering of the hull, an iron ship becomes a magnet during its building, and naturally this will affect the compass so as to make it inaccurate. It is therefore essential that this be allowed for. There is a difference in the tendency of this error according to the direction in which the ship's head lay during her building. Thus, supposing the bow of the ship was towards the south when being built, the tendency of the compass will be for the north-seeking end of the needle to be drawn towards the bows, the rule being that the north-seeking end of the compass needle is always drawn towards that part of the ship which was south when building.

Nowadays, when the motion of a ship in a rough sea, the constant vibrations of the engines, and, in the case of men-of-war, the severe shocks from the firing of heavy guns, have a tendency to cause the compass card to get into a swing and to go round and round in such a manner as to make it useless for the purpose for which it was intended, special means have to be provided for counteracting this fault. The error which an iron ship would otherwise make on the compass is overcome by applying correctors to compensate for the error that would be made. After a vessel has been launched, it is better that she be turned round, and kept, if possible, with her head facing exactly the opposite direction to that which she had occupied when building, so that she may lose as much of the magnetism as possible before she is ready to proceed to sea.

The reader is probably well aware that in order to ascertain the depth of water under a ship, a lead attached to a line is thrown overboard, the other end of the line, of course, being retained on board. Whilst this is still in daily use on board smaller ships, there are serious drawbacks to this old-fashioned method, for it involved a great amount of trouble and took a long time in the operation. But as ships became much higher out of the water, and their speed increased to such alarming limits, it became necessary to find some better method, and to the brilliant and inventive brain of that rare genius, Lord Kelvin, who recently passed away, is due the introduction of the modern sounding machine. This consists of a drum mounted at the stern of the ship, and immediately recognisable by any one who cares to look for it on a modern liner. Several hundred fathoms of fine steel wire are allowed to run out from the drum over the ship's stern, the passage through the water causing it to keep clear of the propellers. Attached to the wire, at its end, is a sinker, which, as soon as the wire is allowed to run out, descends rapidly to the bottom of the ocean, just as the lead at the end of the line would obviously fall to the same. With Lord Kelvin's machine, so soon as the sinker touches the bottom a brake is applied to the drum, and the wire which had been allowed to run out is now wound in again. The actual depth of the sea is naturally less than the amount of wire which has been run out, but a recorder which descends with the sinker is used for giving the actual depth. When a ship has made a long voyage out of sight of land and she believes herself to be approaching the land on the other side of the ocean, she takes soundings in this manner, and compares the amount registered with the depths of the ocean (given in fathoms) which are marked on the chart. This is, therefore, a most useful check on the other reckonings which have been obtained by other means in order to determine a ship's position. Thus, for example, supposing an American liner has had an average passage across the Atlantic and believes herself to be approaching the end of her voyage and in the vicinity of the Banks of Newfoundland. The chart gives the depth in fathoms thereabouts, and this will be less than the depth in the clear ocean. The sounding machine will speedily determine matters when one of the officers goes aft and sets it to work.

Although every effort is made at twelve o'clock each day to ascertain a ship's position when out at sea by means of an instrument called a sextant, which measures the altitude of heavenly bodies, yet it is by no means a rare occurrence for the cloudy or perhaps foggy condition of the sky to render the employment of this instrument impossible. It becomes then necessary to rely on the reckoning made by means of the distance run since the previous midday. This is ascertained by the patent log, which consists of a small propeller-like article attached to a line, the latter being made fast to a dial fixed on board of the ship. As the ship goes through the water this propeller-like formation is caused to revolve; the greater the speed of the ship, so much the more quickly will the propeller of the log rotate, and the line with it. The latter, by means of a simple arrangement not very different from the familiar cyclometer, used no doubt by many of my readers, directly registers the number of knots and fraction of a knot which the ship has run in any given time.

One of the greatest dangers which an Atlantic liner has to fear is the possibility of encountering derelicts in her track. Perhaps in the last gale some ill-found old steam tramp or Scandinavian sailing ship has become water-logged and unmanageable. Sinking lower and lower into the water until her decks are awash and the continuous pumping has ceased to be of avail, her crew may have been taken off and snatched from their watery grave by a passing vessel; but before the latter has had time to reach her port and report the existence of this floating danger, some other vessel may have followed after and crashed into the obstacle. By law now it is compulsory for the commander of any British ship who is aware of the presence of any floating derelict to notify the same to the agent of Lloyd's at his next port of call, giving full particulars and the locality where sighted. The warning is then published for the benefit of other mariners. Several vessels, able, seaworthy, and commanded by a skilful officer, assisted by a capable crew, have mysteriously disappeared whilst voyaging on the high seas, and there can be little doubt but that in some cases, at least, this disappearance has been due to collision with half-submerged derelicts, barely visible even in daytime, but at night an unspeakable horror to all who traverse the ocean. Curiously enough, while these lines are being written, an interesting example of this kind of occurrence is chronicled. The Allan liner

Ionian, whilst on a voyage from Montreal to the Clyde, was steaming along the broad Atlantic, when one evening the passengers became suddenly conscious of a violent contact. It was soon found that it was no iceberg, but one of these derelicts, and owing to the force behind the *Ionian* and the unyielding nature of the obstacle, the liner had no fewer than forty of the plates of her hull on the port side badly damaged, but fortunately this was above the water-line. She was able to make her port in safety, but her danger at the time was considerable, and she even carried away part of the derelict. Sailors tell you that out there in the ocean, where the sea is enormously deep, if a vessel founders she does not always sink straight down to the bottom like a stone thrown into a pond. She has still left in her so much buoyancy that she will cruise about below the surface of the water for some time, more like a submarine than a ship built solely for surface sailing. Few things more awful and weirdly mysterious can be imagined than the mammoth, monstrous hull of some big modern liner, helplessly wallowing in the mighty depths of the sea, with her cargo and engines going to destruction and her crew and passengers silent and lifeless. Writers of ghost stories sometimes fail to make one's flesh creep nowadays, but there are few contemplations more weird than that we are considering. The ship may not necessarily look much altered in her appearance, and the derelict into which the *Ionian* ran had a yellow funnel with two masts.

During the night-time the officer of the watch is careful to see that the side lights and mast-head light of his steamer are burning brightly and kept trimmed. The course to be steered is either written up on a slate kept in the chart-room or in an order book, and when the officer of the next watch comes up to relieve his colleague, the former examines the orders before taking charge. The condition of the barometer is noted every four hours, and frequently during unsettled weather. There is a proverbial rule which obtains among officers which has been insisted on again and again, and warns them never to forget the three great "L's" of their work. These are "Latitude, Look-out, and Lead"—or, as it is now more frequently, a sounding machine. Before the master of the ship—strictly speaking, there are no captains in the mercantile marine—leaves the deck and turns in for his well-earned rest, he sees that the chart is on the table of the chart-room for the use of the officer in charge, and gives instructions to be called in all cases of doubt. The ship's carpenter—now somewhat of a misnomer, since the steel ship contains but little wood—includes among his duties that of ascertaining the amount of water the vessel has shipped in bad weather and examining the condition of the pumps, and in the event of more water than usual being discovered he immediately reports the same to the engineer of the watch as well as to the captain. When the officer on duty notices the approach of a fog or thick weather, the presence of a large number of ships, or anything out of the ordinary, such as thick volumes of smoke right ahead, he reports the same to his captain.

The carpenter also sees that the tarpaulins cover the hatches effectively in bad weather, but when a spell of fine weather ensues he sees that the ventilation covers are taken off and a current of air allowed to circulate, care being used that the covering is replaced before dark.

The recent introduction of wireless telegraphy has been the means of not merely keeping in touch with the land for many hundreds of miles, but actually saving the lives on a sinking ship. Several notable instances of the latter being no doubt fresh in the reader's mind, it is not necessary to allude to this in great detail. A ship which has struck a derelict, whether by day or night, and is fitted with this wireless gear, can snap out her "Come quickly—danger" signal across many miles, indicating roughly her position, and one or more of the voyaging liners will come speedily to her aid. Not so very long ago a lightship off the North American coast began to sink, and although she was a considerable distance from any port, by means of her wireless gear she was able to communicate with the shore, and a powerful, speedy tug was despatched, full steam ahead, to the sinking vessel. She arrived, happily, just in the nick of time, and was able to rescue the crew before the vessel went down into the cold dark waves. On some liners fitted with wireless telegraphy news is transmitted daily from Great Britain as the ship keeps within talking distance of the land, and when approaching the American shore the news is flashed from that side. This is taken to a small editorial office placed in the ship, and a daily paper is printed on board in time for the passenger as he emerges from his comfortable state-room and comes down to breakfast.

But by an arrangement with the British post office it is now possible to despatch radio-telegrams to a ship for some time after she has left her port. The telegrams are handed in as usual at the local post office, and thence despatched by the land lines as far as the coast. From there they are flashed by means of wireless telegraphy to the ship desired; and not merely to liners is this applicable, but to those of his Majesty's ships thus provided with wireless gear. Masters of incoming liners find this very useful for reporting ships in distress, the presence of derelicts, any accident on board delaying the ship's arrival, and so on. The writer remembers being on board a liner once when it was applied to another purpose. It became known that certain suspected culprits were on board whose arrest was highly desirable, so wireless information was sent across the ocean requesting detectives to meet the ship on arrival at her port of destination, which was accordingly done. The United States Government have an excellent system of transmitting valuable information by this means to incoming or outgoing ships, announcing the presence of icebergs, wrecks, derelicts, and other obstructions to navigation. This information is transmitted daily at six in the morning, two in the afternoon, and ten o'clock at night.

At night-time ships belonging to different lines have private signals for notifying to a lighthouse or headland their arrival off the land, so that the information may reach their owners ashore, and preparation may be made, if necessary, for the handling of luggage and despatch of passengers by train. These signals are of varying nature, but consist of sending up rockets of a definite description, or burning certain coloured lights in a special manner. For instance, the Cunard liners when they are passing Brow Head in the county of Cork, or off Queenstown Harbour, send up a blue light and two rockets which burst into golden stars, these being fired in quick succession. They can also "speak" passing ships on the high seas at night by disclosing their identity by this means. Thus a Cunarder would in such circumstances send up a blue light into the sky followed by two Roman candles, each throwing out six blue balls to a height not above a hundred and fifty feet. Or, to come to vessels engaged on much shorter voyages, the cross-Channel steamers have also their code. The Dover-Calais steamer, for instance, might have the misfortune to be disabled, or might wish to warn her sister ships that there are obstructions in the port she has just left, or that she is unable, owing to the sea running, to enter harbour, and is returning to the other side again until the weather moderates. For this purpose a series of pyrotechnic lights is employed, which can carry the information to the shore even if the wireless telegraph gear should have been put out of order by any chance.

When a vessel has the misfortune to be wrecked along the coast, a local officer of the district, known as the Receiver of Wrecks, proceeds at once to the place where the ship is stranded, and his powers are so great that he then and there takes command of all the persons present, and does whatever he can to save ship, cargo, and people; but he has no authority to interfere between the captain and his crew in the management of the shipwrecked vessel. He can call upon the masters of other vessels, however, to assist him if they are near at hand and their help is required in any way. Thus he may require them to tow the ship off, or to launch their boats and to lend the aid of their men, and in the event of there being a refusal to render help, the refusers are liable to a heavy fine; and even those farmers and others in the vicinity who decline to lend the services of their carts and horses, or to allow the Receiver of Wrecks to pass over their fields, are equally liable to such a penalty. In order to prevent petty pilfering, as carried on extensively in the old lawless days, the Receiver has charge over all goods washed ashore from the ship, and any one removing these without permission is severely punished; and even when the goods have been recovered by the actual owner he is bound to inform the Receiver about the matter. At the same time, those who have been engaged in the salving of the ship and her contents are entitled to their reward, usually about one-third of the value of the property recovered, and this the owner has of course to pay. If the latter should not do so, then the goods are sold to pay the claimants. There are certain parts of the coast, noted for the outlying dangers, where the local fishermen at times make quite handsome sums in reward for their salvage work. Every one knows of the dangerous proximity of the Goodwin Sands, on which many a good ship has been stranded, perhaps on a foggy night during her return voyage to London or Hamburg full of valuable cargo, and perhaps even with gold in large quantities aboard. She may have got on the sands at high-water time, and her position becomes one of the greatest peril and of anxiety to her owners. Tugs and shore-boats will put off from the neighbouring shore and rescue passengers and cargo, even if it is found impossible to do much for the ship herself. When the time comes for settling the amounts to be paid to the salvors, quite a considerable sum will have to be expended. It is only recently that no less a sum than £10,000 was paid by the owners for salvage done to one of their ships.

Eventually the vessel may arrive safely in port, and the cargo and passengers reach their destinations little the worse for their experience, but the unfortunate captain will have forfeited the confidence which had been placed in him, and in more cases than not he has ended his career. Although to err is human, it is very costly when in charge of a big, precious ship, and he will never have command of such a vessel again. Though he is otherwise as skilful as could be wished, he will never be seen on the bridge of a liner any more; but perhaps, after a time, he will cross the oceans and roam over the globe in charge of some tired old steam tramp, like himself a sad and sorrowful creature.

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The names of vessels are indicated by italics.

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THE END

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